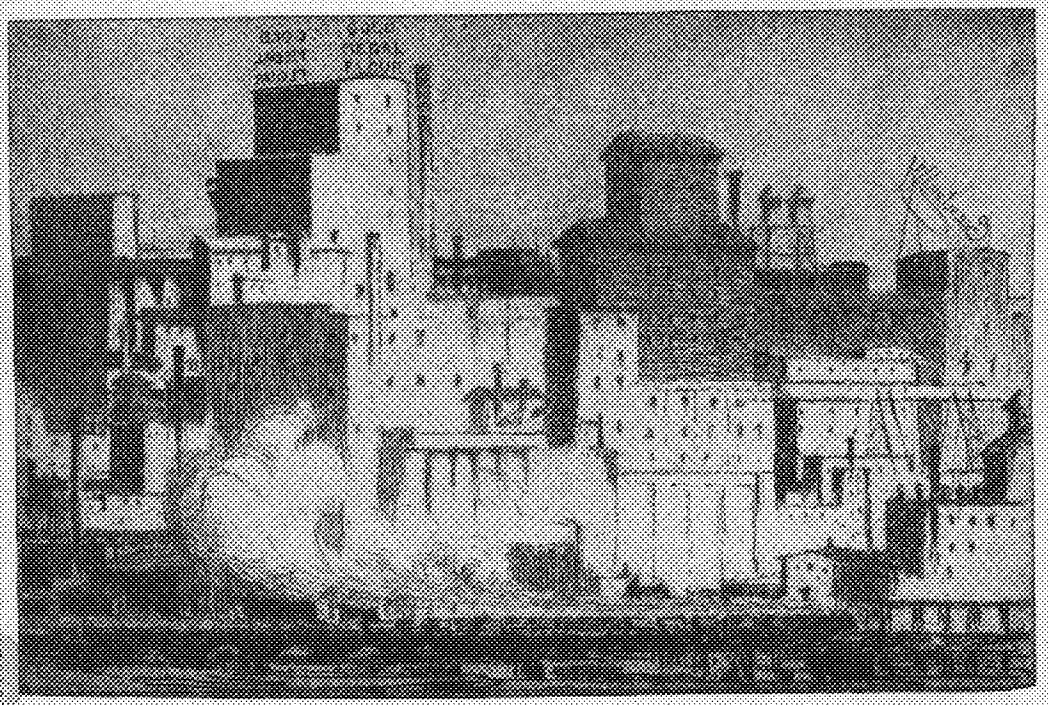
MINNESOTA TECHNO-LOG



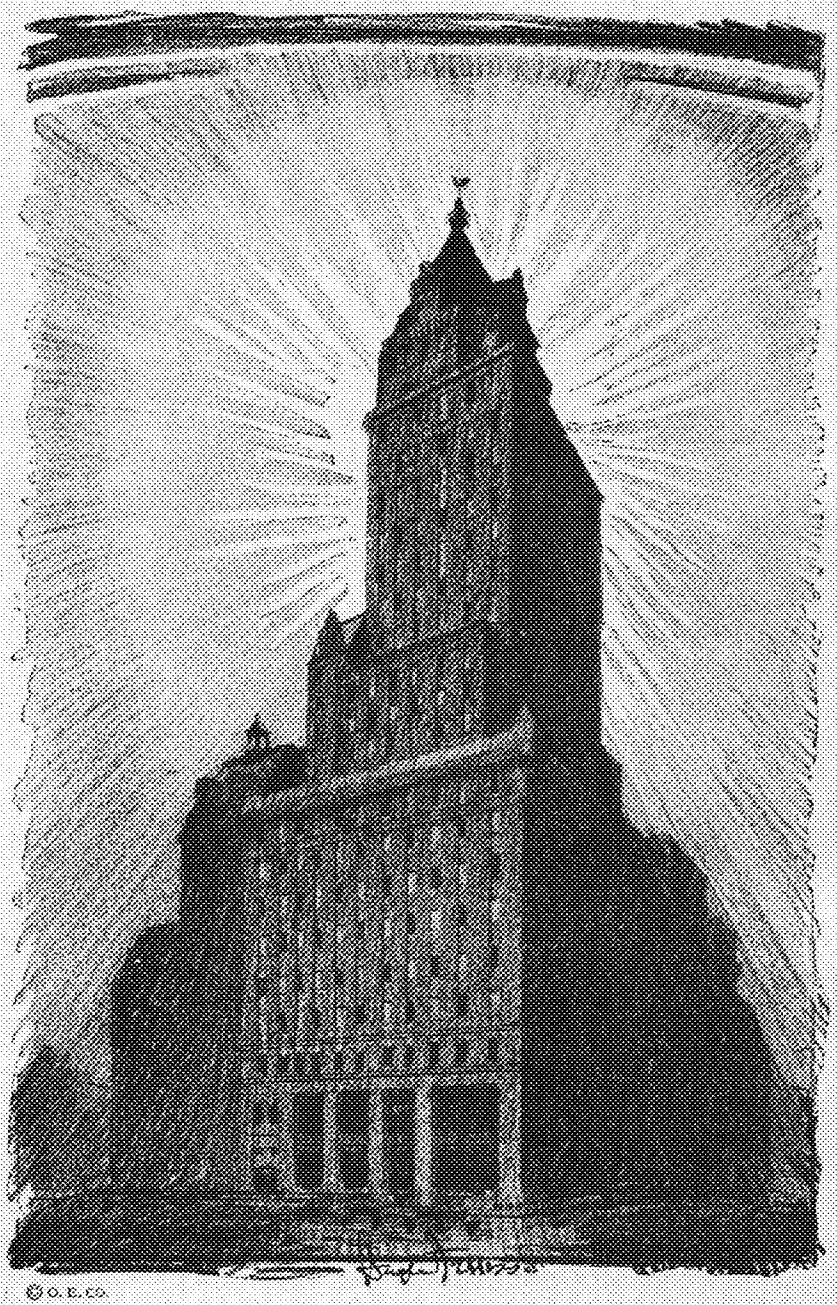
"OUR MILLS"

NOVEMBER 1922

PUBLISHED MONTHLY DURING THE SCHOOL YEAR BY THE STUDENTS OF THE COLLEGE OF ENGINEERING AND ARCHITECTURE AND THE SCHOOL OF CHEMISTRY.

VOL. III UNIVERSITY OF MINNESOTA NO. 1

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED



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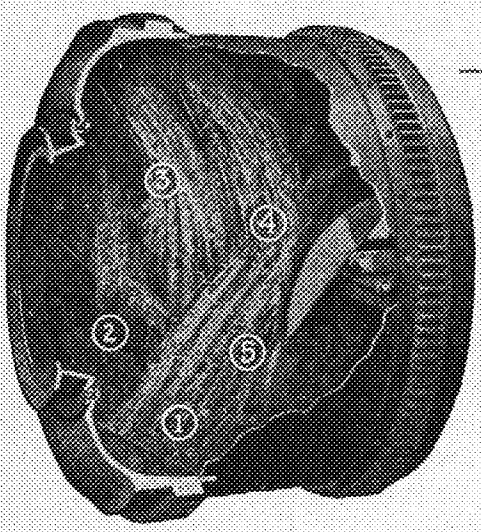

(1) Blade cuts through materials with churning action. (2) Blade carries materials up, spilling down again against motion of drum. (3) Materials hurled across diameter of drum. (4) Materials elevated to drum top and cascaded down to reversed discharge chute which (5) with scattering, spraying action, showers materials back to charging side for repeated trips through mixing process.

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MINNESOTA TECHNO-LOG

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University of Minnesota

VOLUME III NOVEMBER, 1922 NUMBER 1

THE NAVY'S RELATION TO INDUSTRY

Economic Value of Sea-Power Discussed. Commercial Development of a Nation is Due to Ships

By Lieut.-Com. R. R. M. Emmett, U. S. N.

THE people of the United States are today confronted with their destiny and that destiny lies in great measure on the sea.

The young man of ambition has a different picture presented to him as he goes out into the world, than had his father or his grandfather before him.

For three-quarters of a century the most attractive careers for each rising generation lay at home. Ours was a country of boundless natural resources, of noble opportunities. There was no limit, other than a man's ability, to what could be accomplished at home. Our relations, both political and economic, with the world abroad were extremely simple. There was no economic demand that our people should go down to the sea in ships, and hence we have had no merchant marine worthy of the name. Having no merchant marine to support and secure, our Navy waned to a nominal force, largely composed of old and obsolete ships. It was natural that this should be so. There were no political or economic reasons for maintaining a greater force.

Young men launched into the world today face a new perspective. The United States stands as a world power. Its commerce carried in American ships, manned by American citizens, secured by an American navy, second to none, will traverse the seven seas.

I know nothing more important to commend to the minds of our young men than, first to study the inevitable influence seapower will exert on their country's future economic development; and then, to translate convictions gained into deeds which will react to the security, prosperity and happiness of our great Republic and its people.

(Signed) EDWIN DENBY.

Creation of Our Navy

As the country discovered and developed its great natural resources and grew rich and prosperous, men of vision here and there, all over the country, foresaw the need of securing our prosperity. A start was made toward the creation of our modern Navy. Men preached the need of developing merchant shipping to transport our products throughout the world.

Progress was necessarily slow. Opportunity to live comfortably ashore abounded, and men were slow to earn their bread at sea.

The Spanish-American war, with its aftermath of new interests and responsibilities, pushed on our naval development. The manifest need of securing the Monroe Doctrine from the selfish assaults of foreign powers continued the expansion of our Navy.

The application of the Monroe Doctrine has successfully safeguarded, for one hundred years, the affairs of this hemisphere from complications that might have threatened the peace of the world. It has permitted the people of all nations in the two Americas to work out their national problems without interference or exploitation from abroad.

The outbreak of the World War plunged us, whether we would or not, into the turmoil of world affairs. We have emerged from that conflict, for the present at least, the richest and most influential nation in the world. Whether we are to maintain our present relatively happy position in the family of nations rests with ourselves. There can be no doubt but that the genius and industry of our people, the soundness of our political and economic institutions, will enable us to bear prosperity as well as we have supported and borne the strife for prosperity. We must, however, take stock for the future.

New Opportunities Open

We have a large and increasing population, a great portion of which has assumed a highly industrial character. Our natural resources have been pretty well discovered, are in the course of development, and can be accurately estimated. If the standard of living of our people is to be preserved, if we are to be fed as American citizens have been fed in the past, we must make better and more scientific use of both our industrial and agricultural resources. Our home markets now, with the passage of the years, approach the saturation point. It is becom-

ing increasingly imperative to produce more goods than we can absorb at home. The building up and developing of foreign trade and commerce is becoming an essential to our future economic prosperity.

Mexico and the countries of Central and South America are, figuratively speaking, at our doors. Great opportunities await men of ambition, brains and energy in China, Central Asia, the Near East and in Africa.

If our young men go out into the world to compete for the business of the world, they must be served by American ships. If they are served by the ships of other nations, our competitors, they must pay a toll to those foreign ships. If for a time, in spite of that, they are successful, we cannot complain if other nations who control the sea transportation of the world meet our success by taking advantage of such control to prevent our goods from moving about the world with the necessary precision as regards time, amount and place. We must develop our own merchant marine. We can and will develop our own merchant marine.

History Repeats Itself

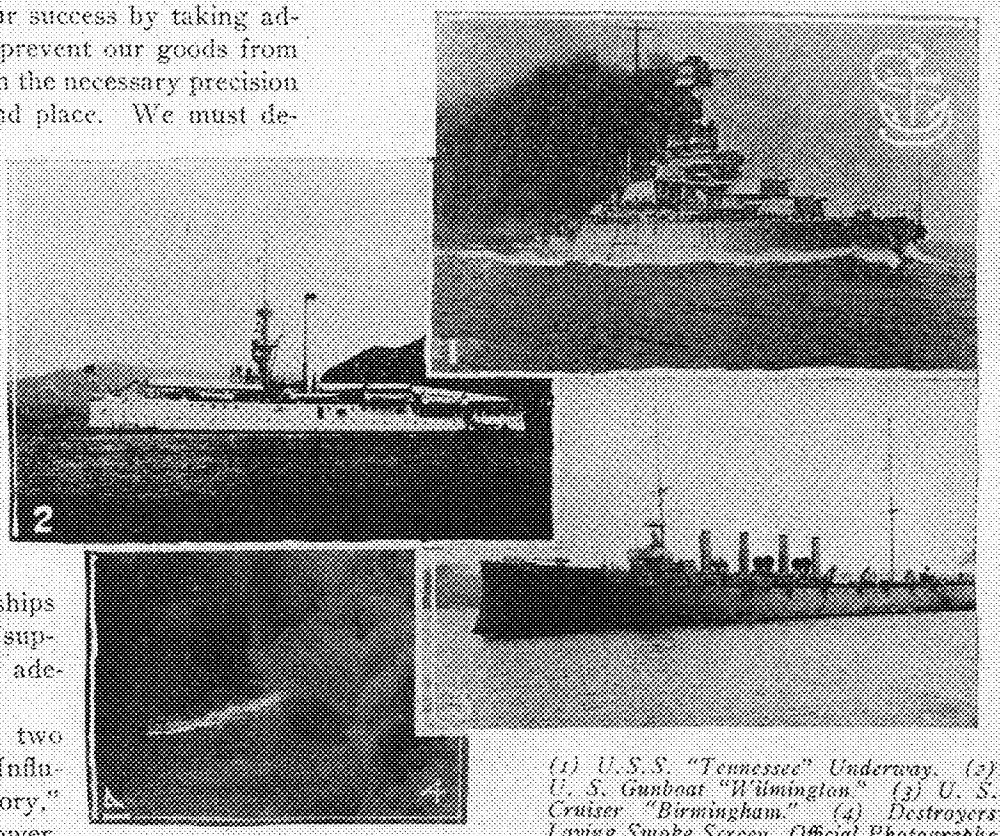
The history of the world can be analyzed and resolved into a few fundamental principles. History invariably has repeated itself and will again. No nation has ever built up a seaborne trade and commerce unless the ships that served that trade were supported and secured by an adequate naval force.

Admiral Mahan in his two great books entitled, "The Influence of Seapower in History," and "The Influence of Seapower on the French Revolution and Empire," traces with matchless clarity the political and commercial development of the Europe we know today. Their contents are being applied by the statesmen of Europe. The history of the Japanese Empire in the past twenty-five years has been substantially guided and influenced by their existence. The principles adduced and analyzed are particularly applicable to our own country, a country that seeks wealth, prosperity and consequent happiness, not by the sword, but rather by honest, industrious labor.

We in the United States have been accustomed to give little thought to our need for a merchant marine, or, if we have considered it at all, only as something seen dimly, in the distance. We have been accustomed to think of our Navy as our strong right arm, as our bulwark in time of war, but as something in time of peace that was necessary, we supposed, but still required a heavy expenditure of the public funds that might be spent elsewhere to more apparent and immediate advantage.

We must revise our ideas; we must renew our perspective. The economic need for seapower is upon us, and by seapower I mean a fleet of American owned, American manned ships, running from great commercial ports to the ends of the world and back, supported and secured by a Navy trained to the razor edge of efficiency and second in power to none other on earth.

Nothing is more important to the future interest of the United States than a thorough realization by the rising generation of the great influence seapower will inevitably exert on their prosperity and happiness.



(1) U. S. S. "Tennessee" Underway. (2) U. S. Gunboat "Wilmington" (3) U. S. Cruiser "Birmingham." (4) Destroyers Laying Smoke Screen. Official Photographs U. S. Navy.

"Those who are just beginning their college training will find themselves confronted, sooner or later, by the problem of outside activities, and with some students this will perhaps take the form of activities versus studies. Let no one be led into the belief that these activities come first and studies second. Each man must decide for himself what and how much he can profitably do. A good engineer is cautious and conservative, not a speculator and plunger."—Dean F. E. Turneaure, of Wisconsin.

THE SIGNAL CORPS SUMMER CAMP

Military Instruction Mixed With Entertainment in Six Weeks Spent at Camp Custer

By LeRoy A. Grettum

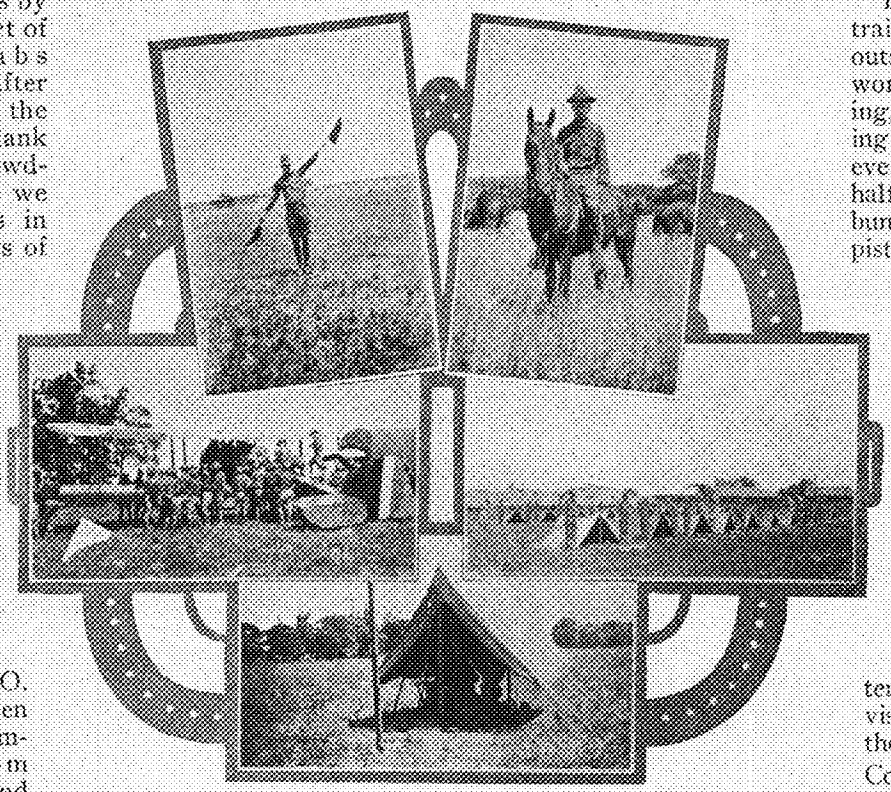
SHORTLY after the close of school last spring 22 advanced and basic members of the Signal Corps, R. O. T. C., left for Camp Custer, at Battle Creek, Michigan, to attend the annual summer training camp. In spite of the earnest efforts of a certain freshman to break his neck by a fall from a galloping horse, the same number returned some seven weeks later in much better condition physically than when they left.

The trip down was pleasant enough to Chicago, kindly old Uncle Sam setting us up to berths and dining-car grub, but from Chicago to Battle Creek it was not so good. The country passed through being hot and dusty, and the so-called train having seen better days, we were a disgruntled bunch when we stretched our legs on the brick pavement of the town made famous by corn flakes. A fleet of military taxicabs awaited us, and after a six-mile ride on the soft side of a plank seat in an overcrowded army truck, we found ourselves in front of some rows of squad tents, which we called home for the next six weeks.

Besides the Signal Corps detachment, Co. F, there were three companies of infantry, a company of engineers, and a cavalry troop, in the R. O. T. C. camp. The men composing these companies came from every university and college in the middle west, and not the least of the benefits received was a splendid opportunity to meet men from other schools and to learn of their activities. We soon got to pulling together, and it was a positive pleasure to see how all hands co-operated in making life miserable every night for the cavalry troop. Members of said troop, determined to wear spurs everywhere, even to dances, soon became fair game for every other man in camp.

The camp itself, so far as we were concerned, was on the whole well managed, and everything possible to make it pleasant for us during our stay was attended to. Captain Watson and Sergeant Stryder earned for themselves real freindship and respect from every man in Co. F, and the other officers detailed to the Signal Corps were not far behind. The location of the camp is unfortunate, in that the country is hot, dry, and sandy, with plenty of wind to move the sand around. The female population of Battle Creek had seen uniforms before, which made it hard for some of the boys.

Sunday excursions were popular; nearby summer resorts and lakes were the scene of several picnics. We also went through the famous sanitarium at Battle Creek, the Post Toasties and Corn Flakes factories, and went through the Roamer automobile factory in Kalamazoo. Captain Watson also arranged a trip to Detroit for us, where we went through the new Connors Creek power plant, the Ford factory, and had time left for sightseeing.

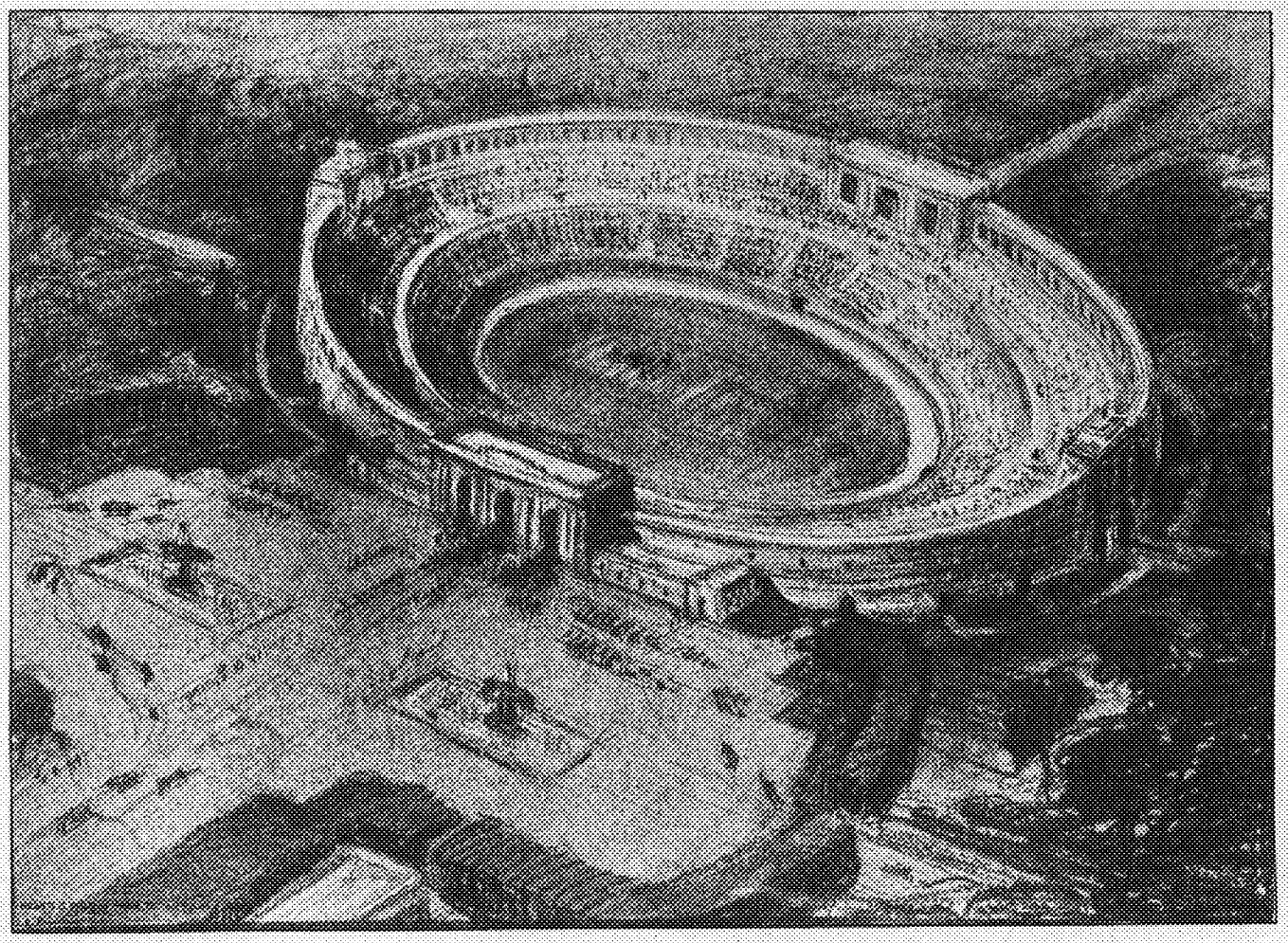


Upper Left—Learning to Spell. Upper Right—Our LeRoy on a Horse. Left Center—Taking It Apart. Right Center—Inspection. Lower—Field Transmitting Station.

The most interesting training we received outside our regular work was pistol shooting, riding and dressing in a minute flat every morning. Over half of the Minnesota bunch qualified on the pistol range, and there were half a dozen fair riders in the gang by the time camp was over. All of us qualified in the dressing contest.

After camp broke up, July 26, some of the seniors took an extended inspection trip, visiting such plants as the Illinois Steel Company, the Allis-Chalmers Company, and the American Steel and Wire Company.

Following are the names of the men who attended the camp: Robert Hargraves, James Johnson, Harold Fischer, Henry Lieberman, Robert Ryan, Clarence Teal, John Holbeck, LeRoy Grettum, Clarence Zimmerscheid, Harold Pause, Charles Burrill, Elmer Engstrom, Alvin Ward, Herbert Scott, John Wiggins, Donald Thorne, Otto Heidleberger, Robert Tunell, Ellwood Braasch, Merton Williams, Neal Garbo, and Frank Cadwell.



An Architect's Drawing of the Stadium.

ENGINEERS BACK STADIUM DRIVE

With Prominent Men as Leaders, Knights of St. Pat Show Old-Time Spirit

By Herman Weicking

E. B. PIERCE has made the remark that the Stadium-Auditorium Drive would be a challenge to the real Minnesota spirit. The Engineers accept that challenge and will go over the top in the same indomitable spirit that has characterized their undertakings in the past."

This statement, issued on the eve of the opening of the Campus Memorial Fund Drive, by far the greatest project ever undertaken by the student and alumni body of the University of Minnesota, was made by Irving Marshman, chairman of the drive in the college which is known all over the campus and wherever Minnesota alumni gather as the best organized and most spirited college on the campus.

St. Patrick's Day Spirit.

"St. Patrick was an Engineer," is the thought that immediately strikes everyone when the College of Engineering is mentioned. The annual anniversary of the patron saint is looked forward to by the University student body as is no other day in the academic calendar. This day is given over to the school with the greatest college spirit that exists, and it is this spirit that causes St. Patrick's anniversary to be what it is to the University.

To say that the Engineers will go over the top in the same indomitable spirit that has made them famous means that this week is a continuous St. Patrick's day in their college. They are known for their school spirit, and when the Engineers undertake something, every individual in the College puts forth every effort possible, and the result is that the project is a huge success. This is a Minnesota tradition.

The Stadium-Auditorium Drive is just one more project to which the Engineers have given their approval, and when the drive is over, and a complete success, every individual in the College wants to hear the entire campus say: The Engineers have lived up to the old tradition. They are the livest bunch, and do everything up right. This campaign is the biggest thing that the University has ever undertaken, and the Engineers are first again.

With the firm resolve of maintaining this famed tradition, a large organization is hard at work. The College boasts of having some of the biggest men on the campus within its ranks, and they all have been included in the 131 men upon whom the job of fulfilling the College quota of $75,000 falls.

Leaders Prominent

Irving Marshman, college chairman, and veteran of two years' service on a submarine chaser, has as division commanders five men, all of whom are prominent in University activities.

Leroy Grettum is president of the All-University Council, and last year was editor-in-chief of The Minnesota Daily. Roy Olson was All-University junior president last year. Harold Peckham was chairman of the last St. Patrick's Day celebration committee. Hibbard Hill and Harley Langman, senior and junior class presidents respectively, complete the list of division commanders.

Each division consists of four teams, each of which has a captain and five men.

An Engineers' mass meeting held in the Armory Friday left no doubt about the attitude of the College toward the Drive. Only one other college, because of its size and turnout, was required to use the Armory for its assembly. President Coffman, E. B. Pierce, Dean O. M. Leland, John Ahlen, a Law School four-minute man; Adrian Kearney, last year's Engineer and captain of the Varsity basketball team, and Hibbard Hill spoke. The Engineers, with the second largest quota in the University, filled the old building to the doors, and in no uncertain terms pledged themselves to add additional honor to their patron saint by again being first at the close of the drive.

Personnel of Teams

The personnel of the organization follows:

Division I. Leroy Grettum, commander. Team 1, Louis T. Baumgardner, captain. Ralph Dunnavan, Fraser McGregor, Robert McCullough, John B. Wiggins, Adrian Kearney.

Team 2, Caryl Chapin, captain. Cyril Posek, Charles Rheinstrom, Glenn Westigard, Clarence Westigard, Homer Tathame.

Team 3, Phil Bergquist, captain. Lyle M. Leland, John Schlenk, Herbert Liese, Earl Spokely, Einar Nelson.

Team 4, Raymond Spencer, captain. Grant Bergsland, D. W. Dale, John H. Moore, Gust Bodin, George F. Berry.

Division II. Roy H. Olson, commander. Team 1, Lloyd Pelley, captain. A. T. Miller, A. B. Greene, Wayne Feeney, Cliff Schweiso, Russell Nash.

Team 2, Harold Pause, captain. Frank W. Wilson, Robert Hargreaves, James P. Johnson, Roy N. Williams, Harold Nee.

Team 3, Paul Swanson, captain. Raymond Racey, Arthur Zimmerman, Lloyd Mitchell, Frank Christlieb, Philip Hartmann.

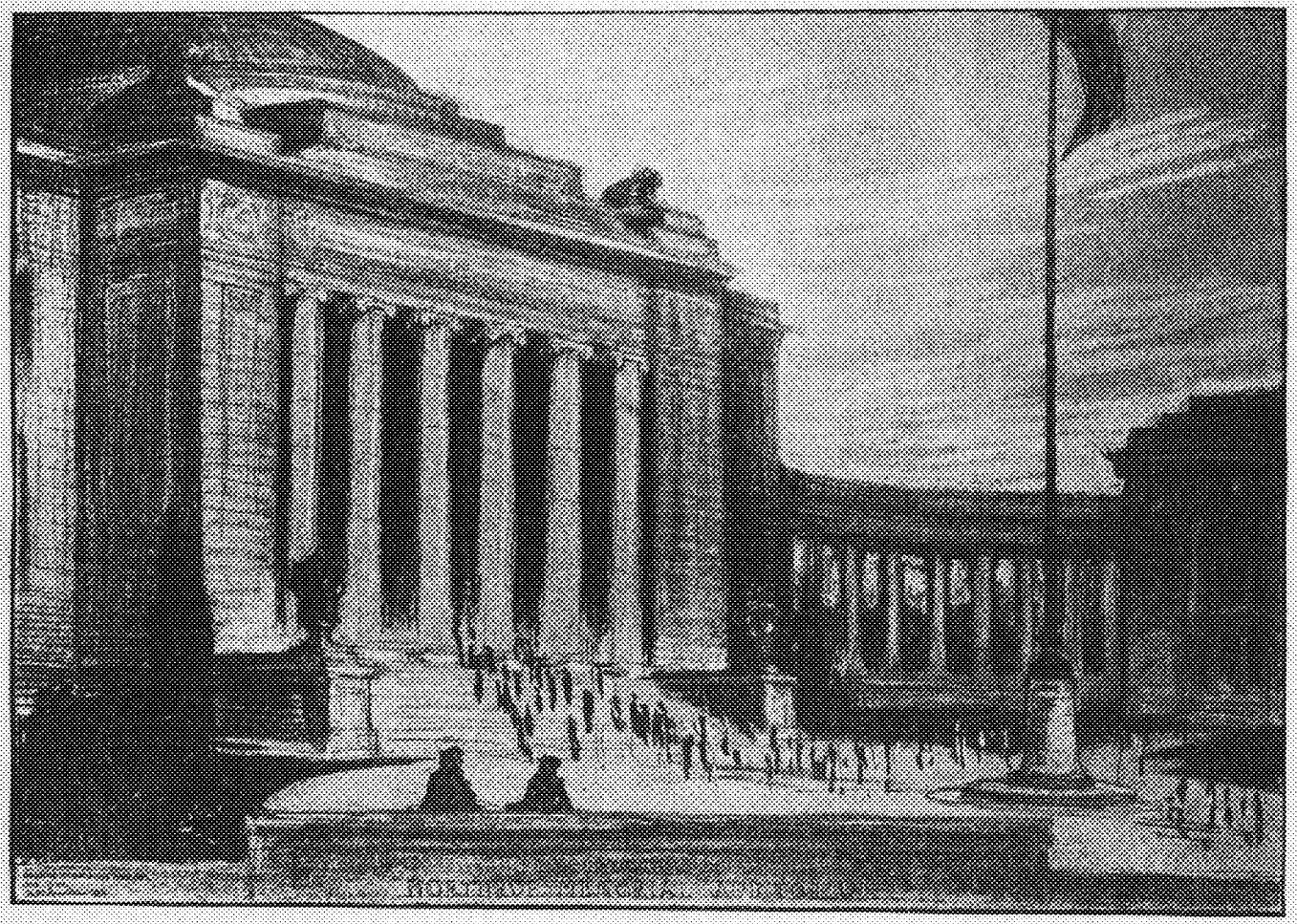
Team 4, Clarence Luedeman, captain. Samuel J. Sutherland, Otto Person, Ted Krafft, John Walquist, Stanley Gardner.

Division III. Hibbard Hill, commander. Team 1, Rudolph Kuhlman, captain. J. W. Ward, Delton Waby, David Kopp, John Daly, Leighton Bellin.

Team 2, Lloyd Peck, captain. Elliot Ludvigsen, Joe Mayer, J. G. O'Neil, Otto Neidelberger, Walter Maiser.

Team 3, Aubrey Leonard, captain. George C. Bester, Ed Fulton, Theodore Schilling, Orville Hosmer, Clifford Sampson.

(Continued on page 21)



The Proposed Northrup Memorial Auditorium.

THESE CIVILS ARE SURE ROWDIES

A Stranger Looks Into the Civil Camp and is Told all the Scandal

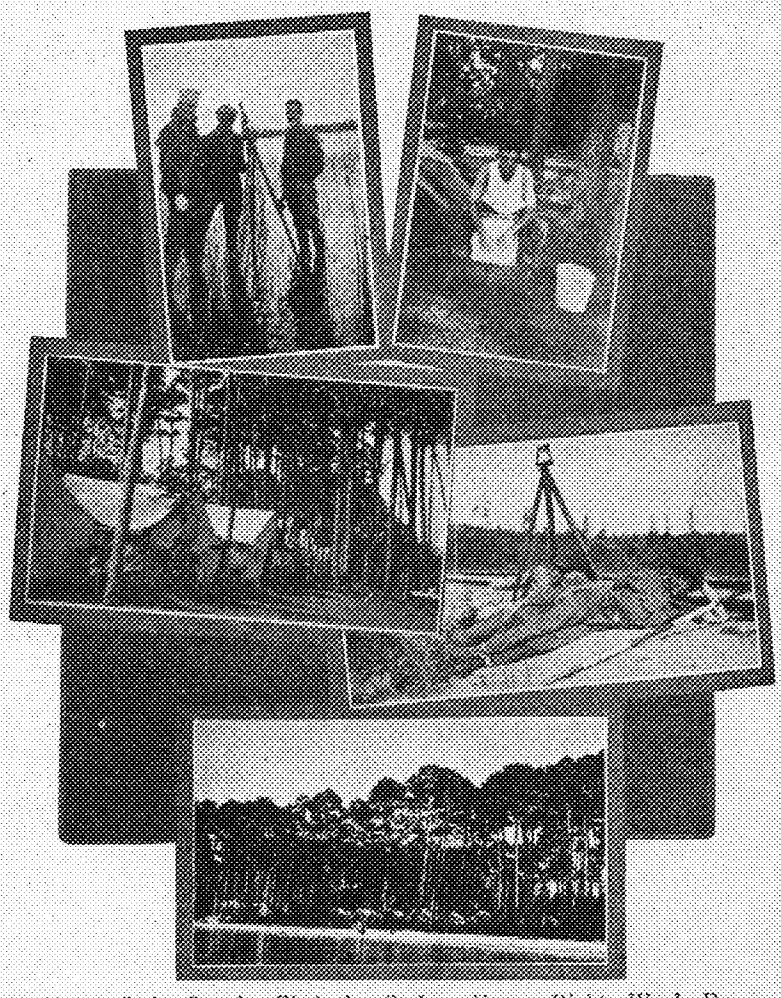
By "Mike" Mitchell

The Summer Camp is a compulsory subject for all Civil engineers, and is taken during the summer between the junior and seniors years.

Bonjorr Niche! Oh no you ain't an Indian, your a Swede. Yes, this is the 1923 Civil Engineers' summer camp at Cass Lake. Do here? Why, we do all the mean jobs those two fellows living in that small tent up the beach cook up for us. Ya, they're the big men in this camp. One of them, Mr. Cutler, buys the beef, and the other, Mr. Zeiner, is the guy what spills the ink on the paper what sez what we're goin' to do the next day. He thot I didn't know the gag of gettin' a guy to shoot a polaris in the middle of the night, but I was hep to all those snipe shooting games.

That next one there is the office tent. That's where the boys sometimes draw maps, Spencer sketches, and we all draw mail onct in a while. Also Nels Johnson spends his Sundays and holidays, and any other time that he isn't in his tent or sleeping on the mess table. Naw, that isn't a woodchuck over there, that's Bill the Cook. He lays abed four hours out of the 24 in that little tent alongside o' that next big tent. The other twenty he's collecting the aggregate for the bif sandwiches for our 11 o'clock lunches in the field. He has an awful grouch on in the mornin' but along about 3 in the afternoon you can talk him out of a piece of pie and believe me Bo it's some pie, and I know cuz I et five pieces the day I was camp asst. You see those other two ginks scrubbin' pans there, they're the cookees.

That smell? Oh, that's only five dead skunks under the kitchen which Bill poisoned. Only strangers notis such familiar odors. This tent next to the kitchen is the mess hall where we throw it down twice per day and three times on Sunday.



Upper Left—Puzzle, Find the Stake. Upper Right—Wash Day. Left Center—The Main Drag. Right Center—Waiting to "Shoot" Polaris. Lower—The Camp from the Lake.

More work is done here than elsewhere in camp. It has been rumored that Cutler calls roll there at 6:15 every mornin' but no one has ever got up early enough to ketch him at it. That row of tents there is where the guys make themselvs parallel to the earth whenever the chance to sneak away permits. In that first tent there are two swedes, one norwegian, George Schaller, and there was one white man; but he found a chance to escape by inducin' his wife to come up from the big city and renting a cottage nearby, whether he paid for it or not I do not know. Bergford, the Norwegian, would have won first prize in bootshinin' if he had not been handicapped by his extended correspondence. As it was Nels Johnson bein' troubled with no other thoughts and working over time on Sunday managed to draw down first money. One night behind this tent a skunk insisted on standin' so Tennstrom with his firing squad was called to the scene of action and they "rocked" him to sleep. To make a long story short Bergford and Johnson slept in the supply tent but Schaller and Odquist never knew a death duel had been fought in back of their tent, the reason bein' that Odquist removed his hip boots before retiring that night. That next tent holds the squad of neckers. Christlieb's the idol of all the young ladies in town, due, no doubt, to his million dollar smile and to his ability to play the piano for the barber shop choir.

Zimmerman and Leonard also sleep here when there are no Duluth girls takin' the 3:00 a. m. train. The rest of the time Zim plays ball and Leonard plays the barber shop. Villaume tried to induce the authorities to move the camp to Walker but they thot that the local attraction was too great. Swanie, our meek Tau Bet from Chick-ago, with his ever alert mind immediately on arrival at camp took up the study of movies, Buicks, women, and

golf. These neckers are pretty proficient but they can all take lessons from Bullis who resides in the next tent. He won the highest honors in that event and was awarded the white necking sweater. Bullis most generally goes to bed like other folks do but after meeting a Marine one night he tried to sleep in his barracks bag.

Hib Hill that is. No, he's no Sioux Indian. It's from seein' so many mirazshes makes him that way. Macgowan owns that thing. It's a spittoon and saxophone combined. Mac can fill it faster than any man in this tent. He played on it once but after he saw Mitchell cleaning a revolver he decided to lay off the punishment. That candy over there, that corner, Sclaro sells woolen goods when he isn't engineering.

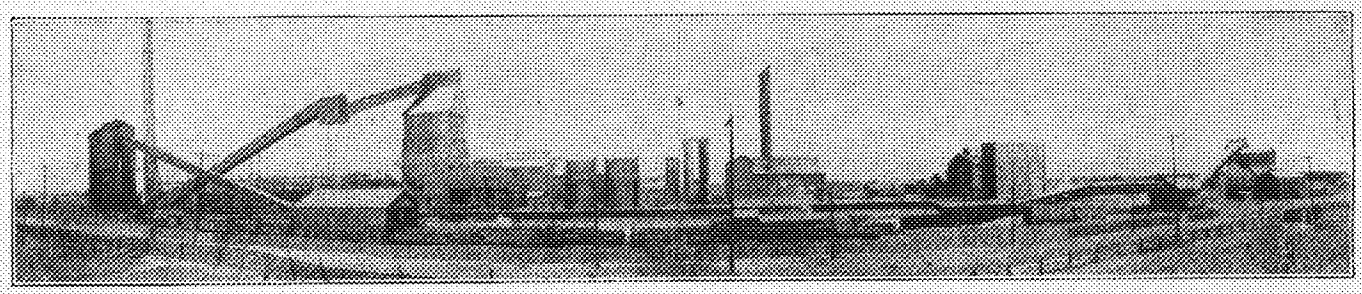
Three blonds and a Romeo live in the next teepee. Olson, Sauer and Schlenk stick pretty close to the reservation but that Maiser guy roams more than Romeo ever hoped to. He and his side kick, Spencer, sure do make the waters of Cass Lake look like the foam on a stein of beer when they ply their oars betwixt Norway Beach and Star Island. Of course we can't blame Spence as he has a cold bunk. Four Swedes shanghaied a Tau Bet in the next tent. Tennstrom's red woolens have faded to a delicate pink, but he said he would wear them till just the wrist and neck bands were left. Al Johnson bagged several snipe over on the point one night. He still

The 1923 Civil Camp.

the chipmunks have been nibbling on? Oh, that's Mike Mitchell's store. He paints those teeth marks over with iodine and raises the price another nickel. It is strickly a cash and carry system and what you can't lift, drag. Curry the young Lochinvar sleeps here too when he isn't out fixing Evinrudes for aged women.

That fellow that just came in and took a piece of candy and put a nickel in the box and took out a quarter is Peterson from the next tent. He is the star customer. He fishes when there is no one around to play poker with. Mickey Judd, Lloyd Peck and De Freece are most generally around though. Arne Aasland, the man that cooked coffee in Paul Bunyan's loggin' camp in North Dakota, also sleeps in that tent. That's Jim Darrell warbling in the next tent. It must be great to be in love. Kelly says it is. Kelly, Darrell, and Tarbell think they have to hide behind that brush on their faces so the girls will keep away from them but Guesmer and Hosmer are protection enough. Kelly kills the chickens for the boys in the next tent. Ya Greenberg, Brody, Lazorwitz, Abramson and Sclarow, running true to form, picked out the best business keeps that powerful laugh, however. High-pockets Thompson slept well on the job but woke up long enough on Labor Day to play a game of baseball. Elmer Nelson and Ed Dindorf were partners in crime. They used to go fishing together but Dindorf was the only one to catch any fish.

Flindt and Stephens in the following tent had an argument whether the Cass county moonshine was 35 or 40 horse-power. It must have been 40 h.p. as a quart of it took them both to Bemidji and back and the ruling grade was six dollars a quart. Kotz and Manger gave the reservation a wide berth on Sunday and would step over to Bemidji before breakfast and then not get any. Spencer's bunk is in this tent too. Don't see why he ever unrolled it. This runt of a tent on the end houses Peter Berg and Tiny Ranger. Berg got kicked out of three other tents and Ranger never got into one until cold weather set in and his heat was needed. Berg can play poker almost as good as Ranger. Well, stranger, I am much obliged to meet you and to show you around. Oh, you are the Federal board boy's Santa Claus, are you? Yes, I guess you can get in a game tonight. So long.



Minnesota By-Product Coke Company.

MINNESOTA BY-PRODUCE COKE CO.

Coal Refineing Firm Is Visited, Many Interesting Processes Seen at Twin-City Plant

By Harold D. Smith.

The following article is the first of a series written for the TECHNO-LOG describing local manufacturing plants. Members of the College who wish to make a personal visit to these plants are invited to do so by the several companies. The author wishes to thank Mr. A. W. Grant, of the Minnesota By-Product Coke Company, for his great assistance in the preparation of this paper.

THE art of coking coal with the recovery of by-products has usually for its prime purpose the production of metallurgical coke, and long since became such a factor in the manufacture of gas that today it is not infrequent to find the major concern of the operator the generation of high quality gas. In either case, other resultant products are always considered in the light of by-products, and the whole brought about by the process of distillation, which takes place within a substantially gas-tight refractory chamber.

In contradistinction, is the process of gasification as employed in making producer gas, blue gas, carburetted water gas, etc., each of which wholly or in part requires the union of oxygen with the carbon in the fuel, the former being supplied from either air, steam, or both, in such a manner as to realize only partial combustion. Combustion may be defined as the development of heat energy during excessively rapid chemical combustion. A crude analogy would be, say, rapid oxidation as opposed to slow oxidation or rusting, corrosion.

Many Conveyors Used

A modern plant functions continuously and mechanically from the time of receiving coal to that of shipping manufactured products. These results are largely accomplished by means of a multiplicity of electrically operated machines and motor driven belt conveyors and loaders, and pneumatic and electric regulating devices and controllers.

The coal mixture is charged into an oven, which being gas fired is maintained at coking temperature, —this can be varied according to the desired speed of plant operation over a rather wide range. All products, with the exception of coke, secured by this process, leave the oven either in the state of gas or vapor, and are appropriately condensed, or manipulated, in specially designed apparatus. The condensate is a mixture of crude tar and weak ammoniacal liquor,—the first mentioned is sold to the tar distiller, or infrequently worked up in a tar plant within the works; the latter is distilled in an ammonia still and converted into anhydrous ammonia or concentrated ammonia liquor, the latter being sold as such. The anhydrous ammonia is then conveyed to the gas line, where it becomes mixed with crude gas and the whole pumped through a bath of dilute sulphuric acid for the formation of ammonium sulphate. The gas then, being freed of its tar and ammonia, is subjected to further cooling, which relieves it of practically all naphthalene, after which it is washed with an absorbent oil for the extraction of benzol products.

Oil Is Washed

The benzolized wash oil is continuously passed through a wash oil still which liberates crude light oil, and the debenzolized wash oil is returned to the benzol scrubbers for further extraction of light oil, thus completing the cycle.

The light oil is next fractionaled in a crude still to crude benzol, crude toluol, crude solvent naphtha, etc., after which these individual products are washed with 66° Be' sulphuric acid, caustic soda and water, in such order, to purify them,—to remove olifines.

Finally, the washed benzols are distilled in a pure still to specification products and are then ready for shipment.

The gas is now ready for use as fuel or illumination, but I should say that in this particular plant all apparatus described is in duplicate for the purpose of making possible the separation of the high quality gas formed during the early stages of carbonization, from the lean gas generated towards the end. The former is used in St. Paul for heating and lighting and represents the major quantity of gas so used; the latter, lean gas, is used at the plant for heating the ovens.

Ammonia Is a By-Product

In describing the uses of our by-products, suffice it to say, that ammonia in one or another of its forms is used for fertilizer or in its manufacture, high explosives, cleaning agents, refrigerant, cosmetics, medicines, etc.; next is benzol and its homologues, besides being used as a solvent in making rubber and other products, a motor fuel of greater power than gasoline, for the manufacture of an in-

(Continued on page 22)

ALUMNI NEWS

FORMER ENGINEERING STUDENT DIES

Herbert V. Hansen, a former student in the College of Engineering at Minnesota, was killed recently in an aeroplane accident at Baltimore, Maryland. Mr. Hansen received a commission as Lieutenant in the Marine Aviation Corps during the war. The accident took place during an exhibition in which balloon sniping was a feature. Hansen was a member of Alpha Kappa Sigma and Kappa Sigma Fraternities. His home was in Church's Ferry, North Dakota.

A. C. Godward, C. E. '10, has been appointed engineer for the Minneapolis city planning commission. Mr. Godward was formerly engineer for the city park board.

Prof. W. T. Ryan, while at the American Tel. and Tel. Co. in New York, last summer, met the following alumni: Charles Demarest, '11; Albert F. Mayer, '20; Russel A. Strothman, '20; A. G. Chapman, '11; Donald P. Loye, '16-17; Donald C. Smith, '18; and Danforth K. Gannett, '16-17.

A. O. Cunningham, C. E. 1894, is chief engineer of the Wabash Railroad at St. Louis, Missouri.

J. Danner, E. E. 1901, is with the Western Electric Co. at LaGrange, Ill.

Geo. P. Svendsen, E. E. 1908, is with the Boustead Electric Mfg. Co. of this city.

J. M. Meany, M. E. 1907, is with the Lidgerwood Mfg. Co., Portland, Oregon.

T. L. Croswell, C. E. '15, is with the Cuyuna Range Power Co., Brainerd, Minn.

Leon E. Battles, C. E. '18, is working for Oliver Mining Co., Coleraine, Minn.

James A. Colvin, M. E. '15, is with the Minneapolis General Electric Co.

John A. Bohland, C. 1895, is bridge engineer for the Great Northern R. R., St. Paul.

A. J. Reu, Chem. '19, is with the Hercules Powder Co., Brunswick, Georgia.

G. T. Peterson, M. C. 1908, is working for the Duluth & Iron Range R. R. at Two Harbors, Minn.

J. B. Frear, M. E. 1910, is with the American Radiator Co., Buffalo, New York.

M. H. Hanauer, C. E. 1906, is representing the Minneapolis Steel & Machinery Co., at Salt Lake City, Utah.

E. F. Carlson, M. E. '22, of gym team fame, is garnering experience from the Minneapolis Street Railway Co.—designing, not driving.

Prof. A. S. Cutler recently attended a meeting of the committee on economics of the American Railway Engineers' Association, held in Chicago recently.

Charles Boehnlein, formerly a member of the U. S. Army aviation corps, now instructor in mathematics, attended the National Aero Congress, at Detroit.

The Sophomores were the first to organize a class football team. McMillan is athletic manager. The other officers are Homen Tatham, president; W. W. Brown, vice-president; Hartman, treasurer; Hart, secretary.

Friends of R. A. Lundquist, E. E. '05, will be interested in the following item from the Southwestern Electrician and General Construction: "R. A. Lundquist, chief of the electrical equipment division, Department of Commerce, sailed on August 10 from New York for a short trip through England, Sweden, and Germany, to study the electrical development in those countries. He is especially interested in the super-power schemes in Sweden and England, and is to give close attention to the rural development in the former country. He also will study the domestic appliance possibilities for American manufacturers in England. This survey of electrical conditions will cover a period of about three months."

Charles E. Tullar, E. E. '01, is assistant patent attorney with the General Electric Company, Schenectady, N. Y. He has moved to Schenectady from Washington, D. C., where he was an examiner in the United States Patent Office.

William L. Miller, E. E. '97, is at the head of the Heat Insulation Company, Winona, manufacturing various kinds of heat insulation from flax and other materials. His son, Archibald, is a junior in the College of Engineering.

Laurence Teberg, '22, married Miss Annabel Trenckholm at her home in Minneiska, Oct. 6, 1922.

H. M. Laude, C. E. '20, having spent the summer doing concrete construction work in North Dakota, expects to return to Minneapolis early in the winter, to locate permanently.

Lawrence Slade and Charles Wilson, both C. E. '22, are now in Grand Marais, Minnesota, with the State Highway department.

R. E. Ost, C. E. '22, of Montevideo, Minnesota, is located with the St. Anthony Falls Power Co.

O. A. Stoutland, C. E. '22, of Brooten, Minnesota, is designing for the Chicago, St. Paul, Minneapolis and Omaha Railroad.

(Continued on page 21)

Football

The 1922 football season is now in full swing, with Gopher supporters feeling 100 per cent better than at any time in the last two years. Our new coach, Bill Spaulding, and his corps of assistants, have given us success far above anything hoped for in the first year of the new regime. While we dare not hope for a championship this year, our team of fighters will give the best teams in the conference a busy afternoon, chuck full of uneasy moments. We have a green team, but the coaches and members of the team realize this fact and are working hard to offset this lack of experience with hard fighting, hard tackling, hard blocking. Every man on the team will be right after that ball all the time. Another feature which Gopher followers are glad to see is the institution of the aerial style of attack which we have enviously watched visiting teams use so successfully against our own team. This year we have a passing combination which will rank with the best, and in addition we have line plungers who remind us of the good old days.

The line has been the most uncertain factor, and the lack of experience of the team has been most keenly felt in that section. Captain Aas is the exception and has been playing sterling ball, an accurate passer, a player who uses his head along with his physical ability, and who steadies and encourages his men at all times. At guard, Spaulding has been using Larkin, Abrahamson, Gay, McCarty, and Gross. The fight for the regular berths has been waxing hot. At tackle, Cox is the shining light, and the big fellow is showing better every game, in spite of injuries. McDonald is the other tackle, and is playing a good consistent game. Ecklund, Scholl, Gallagher, Merrill, Munson, and Moyle are the ends, with the first two in the regular berths. Both men are ranging good on the defense and just the ones to pick Martineau's passes out of the air.

In the backfield, Gross, Myrum and Stew Wilson have been alternating at the pilot job. The other backfield men are Martineau, McCreary, Mitchell, Pederson, Oster, Hultcranz, Furst, and Olson.

As usual the Engineers are doing their share in keeping Minnesota in a prominent position on the football map. Those on the varsity squad are Lloyd Mitchell, Lloyd Pederson, Manly Munson, and Stew Wilson.

Lloyd Mitchell, better known as "Mike," will be remembered by old Minneapolis High School Men, as the terrific line plunger who played on the Central High Team for three years. In his last year, Central lost the city championship to West by a score of 7-6. Martineau and Eddie Rueben were members of the West team at that time. Mike is playing a wonderful game this year and has been working as regular at the fullback job. He is a senior Civil.

Lloyd Pederson, "Pete," is also a fullback, and with Oster and Mitchell makes up a trio of fullbacks which it is hard to beat. Pete played at a backfield position on the Willmar High School team for three years. He is a fiery, peppy player, hitting the line hard, and is especially strong on the defense against the aerial attack. He will have one more year to play, as he is now a junior Civil.

Stew Wilson comes from St. Paul Central. This is the first year he has been out for the team and he is showing up surprisingly at quarterback. He is very fast, and a heady player. Stew made his M. in track last spring, running the 100 and 220 yard dashes, which accounts for his speed on the gridiron. He is a junior Mechanical.

Manly Munson, junior Mechanical, is making a strong bid for an end job on the Varsity. He is of the tall, rangy type, and has shown special ability in forward passing. He was a member of Minnesota's gymnastic team last year, and also excelled in that line at South High. With another year to go, he will make the boys step lively to keep him off the regular team next year.

Engineers on the second team who are doing their share by giving the Varsity stiff scrimmage sessions are: Curry, senior Civil; Spokely, sophomore Civil; Tatham, sophomore Architect; Kiesner, junior Mechanical; Franz, junior Civil; Schubert, sophomore Architect; and Wacholz, sophomore Architect.

The freshman team this year is the cause of much joy to the coaches, as it is exceptionally strong, and assures a wealth of material for next year's Varsity. Engineers who are out are H. J. Ascher, East High; D. Barley, Mechanic Arts High; D. S. Bennett, Quincy, Massachusetts, High; K. B. Bourquin, White Bear High; T. Comfort, St. Paul Central; I. G. Hanke, St. Louis Park High; G. Kronick, North High; C. Kusnierek, Duluth Denfield; F. Schultz, Marshall, Minnesota; and A. Swenson, West High.

The fall intramural sports are booming nicely. More than 55 men have entered the fall tennis tournament, and a large number of embryo Charlie Paddocks are working out with Sweitzer's hopefuls. Every effort is being made to organize a fall golf tournament. In the Engineering School the classes are organizing football teams, and competition will start shortly.

Art Zimmerman has been appointed manager of athletics in the Engineering College. Under him are the following men, responsible for their own classes: E. A. Nelson, Senior; Stewart Wilson, Junior; M. McMillan, Soph., and Earl Hagen, Frosh.

Zimmerman has been elected treasurer of the Intramural Board, on which the Engineering College is again represented by Prof. Zelner, as faculty advisor. Intramural athletics have formerly been made to hum under the direction of Prof. Zelner. Let's hope he and his cohorts will be able to revive the corpse.

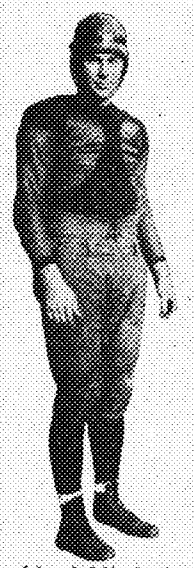
Varsity Sports

A large squad of distance runners are nightly working out under the direction of Merle Sweitzer, star miler last year, in preparation for the cross country meets with Wisconsin here on November 4, and with Iowa at Iowa, November 11. Capt. Winters is easily the class of the field, but he is being hard pushed by Sturman and Ulrich of last year's team. McLaughlin, a new man, has been showing well in practice.

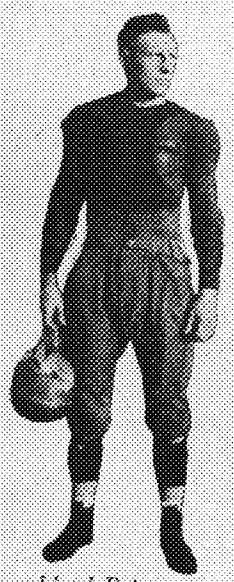
Sweitzer plans to select his team on the basis of proved ability, and to that end races are held over the long course every Friday. Those men who place consistently near the front in these practice tilts will compose the team.

Paul Swanson, Captain of the Gopher golf team, is attempting to arrange team competition with Interlachen. A match was played with Midland Hills, October 14, Minnesota taking the short end of an 8-5 score. Paul also wishes to put on a fall tournament in order to get a line on possible material for next spring's team. Herron and Harding of last year's team are in school and eligible. Howard Malone, Glenwood champion, will be eligible next year. Pond, a now and then engineer, and a crack golfer, is at last eligible for competition. Paul will do well if he organizes a little competition this fall so that we may be sure of seeing Pond in action under Gopher colors.

An ambitious program of intramural athletics has been laid out under the direction of Fred Whittemore. A governing body for intramural sports has been formed, consisting of the College managers of athletics, appointed by the athletic department, with Whittemore as president. These men, eight in number, with the advice of a faculty member, constitute the executives of the intramural sports. Theirs is the responsibility of organizing and directing sports in which every man in the University may engage. Each college manager is especially responsible for his own school, and at the end of his term will be rewarded with a sweater and letter.



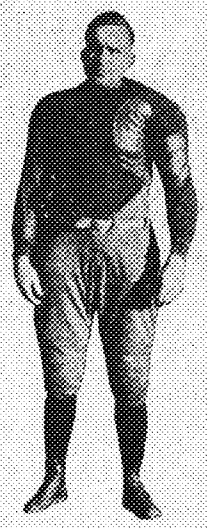
Lloyd Mitchell, Fullback.



Lloyd Peterson, Fullback.

The intramural program as so far developed includes intercollege, interclass, and individual competition in almost every sport. Football and basketball will be freely indulged in, as well as cross country, hockey, swimming, bowling, tennis, handball, and baseball. Equipment will be furnished by the athletic department to whatever amount possible, and letters, with perhaps jerseys, will be given to winning teams and individuals. Sigma Delta Psi trials will be held both fall and spring, and the college managers will assist in running off these trials.

It is now less than a year since the reorganization of the athletic department at Minnesota, yet very definite results of that reorganization are becoming evident. It is interesting to note what has so far been accomplished under the program that Director Leuhring has laid out.



Stuart V. Willson, Halfback.

Undoubtedly the greatest effect of the change in administration has been the increased student interest in athletics. There is a spirit of optimism where formerly all was blackness. This spirit seems to be justified by the results so far obtained.

Since Mr. Leuhring's coming, baseball has started on what we hope is a successful career; the coaching staff has been almost entirely reorganized; new fields have been laid out for football practice, making it possible to have Northrop Field in decent condition for the games. Larger stands have been erected, a step towards providing a student section that is not a mockery, and a fair start has been made towards extensive intramural athletics, though this last can never assume its rightful place until better equipment and better fields, especially the latter, are provided.

Our present football coaching staff, headed by Spaulding, is second to none. Dr. Cooke has displayed his basketball wares for these many years and needs no comment. Metcalf has had as yet no opportunity to demonstrate his track men. Coach Sweitzer, of the cross country team, will shortly display his maiden effort to the public gaze, and Thorpe, swimming coach, with a championship to his credit in his second year as a college coach, is rapidly assuming a place among the foremost coaches of swimming in the United States. A fair showing was made by the baseball coaches last spring, but no definite appointment has as yet been made in that department.

Director Leuhring, in spite of the terrible handicap of lack of room for his department, is showing results that warrant the enthusiastic support of every Minnesotan.

Manager Taylor of the Hockey team has plans well under way for a banner year. While the team will be somewhat handicapped by the loss of the captain-elect, Jacobson, there is a wealth of material in the University, which will undoubtedly respond when the call comes. Taylor plans to start preliminary training about the first of December. Fudge Reeves, former East High hockey and football star, is registered in the Engineering College, and if he decides to go out for hockey, the team will be materially strengthened.

N. S. Anderson, C. E. '22, is with the Corrugated Bar Co., Inc., in St. Paul.

Irving Purdy, C. E. '18, has recently become a proud father.

EDITORIALS

A MINNESOTA TRADITION

Three years ago a wide-eyed freshman came anxiously onto this campus, imbued with a tremendous desire for learning, but retarded in every move by an enervating fear of making ridiculous mistakes or becoming enmeshed in the tangled skeins of official red tape. It was all new to him; the registration lines extending in motley array before the Library bewildered him; the unfamiliar routine at the end of the line was more or less terrifying. But through all this awe-inspiring procedure with its dispiriting atmosphere, he found a single ray of hope that caused a smug feeling of pride to swell within him, for a companion in the line, on learning that this forlorn freshman was to be an engineer, informed him, "Say, buddy, you're going to a ——— of a fine college. They've got some real spirit there."

What made this spirit so wholesome and so effective that it should be a password on the campus? Was it the students? Possibly, but we simply have not the crust to advance that idea.

There is another reason which has been voiced on this campus time and again. The Daily, year after year, has championed its cause. The campus magazines have endeavored to carry its campaign to every University of Minnesota man. Prexy Coffman has spoken of it in his campus speeches, and we remember being enthralled by the fine fervor of Prexy Burton, as he pleaded for and prophesied of the Minnesota Traditions. We believe it is this factor, the wealth of wholesome tradition, enthusiastically observed, that has been one of the mighty forces creative of Engineering College Spirit.

Today we still have the spirit, the enthusiasm, but one of the most potent traditions is rapidly perishing from our campus. It is the Engineers' Scrap Day. After the sporadic scraps of last year came the organized bag-rushes, pushball contests, and tugs-of-war. To one who knew the "good old days" they could hardly fail to seem extremely uninteresting—"sort of papa's boy" affairs.

We realize that the old system, whereby the several colleges held individual scraps, was becoming an onerous burden and must be superseded by some more modern activity, and it is therefore that we suggest that next year's classes get together from the whole campus and produce one unified scrap, interesting yet not too wasteful of time. But, in the interest of all real college spirit, let us forget a little of that paternalistic attitude that is so characteristic a part of all present-day authority.

ENGINEERS AND WORK

Do you want to be an engineer? Are you keen for hard work, and do you enjoy the surmounting of difficulties? Do you experience pleasure when you accomplish something in the face of serious odds?

This is the kind of pleasure which comes to the engineer. Also, this is the method by which he develops.

Note the following statement by President E. M. Herr, of the Westinghouse Electric and Manufacturing Company: Only men thoroughly trained and schooled in gradually overcoming greater and greater obstacles, and who have in this way grown strong, are able to take up burdens larger than before and carry them through to a successful conclusion. Perhaps the most important stage in this development is the college career of the engineering student. If he does as little work as is necessary to pass his courses, he fails to obtain the best training for his profession. If he feels that he cannot force himself to work hard, just for the satisfaction of doing his work well, he should seriously ask himself if he has within him the fundamental characteristics of engineering success.

ORA M. LELAND.

A FEW MORE DAYS

In a week comes the final day of reckoning for some. Those who have meandered along the pleasant ways, unmindful or disregardful of the near future either are or should be bringing themselves to an abrupt "about face." If not, their days here at beautiful Minnesota are meagerly numbered, and, for the last half of the quarter, we shall pursue our routine ways, perhaps somewhat regretfully, without their charming company.

There are others for whom the task has been too heavy, who came unprepared, who were incapable of adjusting themselves to the new conditions and who therefore are suffering the agony of approaching failure. These will be asking of themselves distressing questions, and their troubled self-analysis may bring them to make a wiser choice for the future or make them able to see their faults in such a fashion that they may correct them.

It is for those who are on the brink of failure, who are somewhat in doubt as to the results of examinations, that these next few weeks will be momentous ones. It is not as yet so late that they cannot with a terrific diligence bring their grades up to the required standard. The minimum allowable is hardly the goal to strive for, but, at the present moment, it may be the one attainable result to be considered. This is especially the case with regard to Freshmen and Sophomores taking mathematics and Physics. The rules of the college require that all Freshman and Sophomore mathematics should be completed satisfactorily before any special Junior work may be taken. That means that one failure in Algebra, Trigonometry, Analytics, Calculus, Mechanics, Heat, or Electricity which cannot be retaken during the summer will cost a whole year of school or at least one thousand dollars—a rather high price for a few evenings idly spent or minutes carelessly permitted to pass unused.

As has been stated, it is not too late. Put your shoulder under the load, keep your nose on the grindstone, and brace up.

THE MINNESOTA TECHNO-LOG

PROFIT AND LOSS STATEMENT

September 1st, 1921 to September 23, 1922

RECEIPTS:

1. Subscriptions	$ 470.52	
2. Advertising	1,797.24	
3. Copy Sales	24.00	
4. Miscellaneous Income	13.74	
		$2,305.50
Accounts Receivable, Sept. 1, '21	108.36	
Accounts Receivable, Sept. 1, '22	13.75	
Net to Deduct	94.61	94.61
Total Net Receipts		$2,210.89

DISBURSEMENTS:

Printing and Engraving	$2,053.10		
Office and Publicity	114.38		
Stationery and Postage	53.75		
Advertising Commissions	45.90		
Miscellaneous	32.01		
		$2,299.14	
Accounts Payable, Sept. 1, '21	239.30		
Accounts Payable, Sept. 1, '22	50.00		
	189.30		
Prepaid Advertising	17.38		
Net to Deduct	171.92	171.92	
Total Net Disbursements		$2,127.22	2,127.22
NET PROFIT FOR PERIOD			83.67
DEFICIT OF SEPT. 1, 1921			130.94
NET DEFICIT			$ 47.27

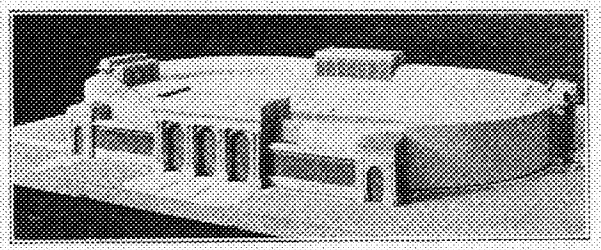
ARCHITECTS

BUILD STADIUM MODELS

A new note was added to the discords wafted from the Music Building during the last week of October by the troops of agonized architects laboring to complete the Auditorium and Stadium models in time for exhibition at the Ohio game.

Embryo virtuosi—whatever they are—were petrified in the midst of impossible études, and vocal-lesson ah-h-h-h's were changed into exclamatory Oh!!'s by the sudden appearance in the halls, ever and anon, of green- or blue-smocked beings, muttering "but the mozikewes in the entourage" and other such foreign gibberish.

In the meanwhile, or rather in the basement, prodigious quantities of paint were being applied to the models. Windows put in their appearance on the blank walls, shadows smote down at the conventional 45 degree angle, mosaics and pavements spread themselves round about. In a word—or rather, in four, plus two words too small for the editors to count—the models were coming to life.



The Architectural Society, in co-operation with the University Shops and the General Drive Committee, was responsible for the fabrication of these models, which were built and decorated in the record time of less than two weeks.

Committees for the rendering of the two models, under the supervision of John A. Walquist, were as follows:

The Stadium

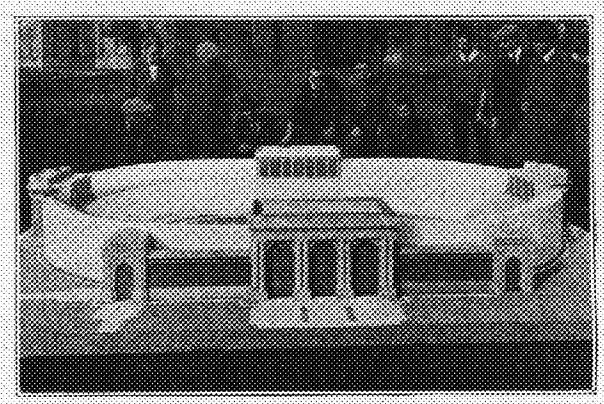
Designer in Charge: Edward Holien.
Bowl Units: C. A. Barnum.
Entrance Units: Wallace Bonsall.
Entourage Units, Field, Etc.: M. J. Markuson.

The Auditorium

Designer in Charge: I. Woodner Silverman.
Colonnade and Terminal Motives: E. W. Kraft.
Façade and Dome: Glanville Smith.
Center and Rear Units: L. A. Tvedt.
Entourage, Court of Honor, Etc.: Roy Boxmeyer.
Accessories and Sculpture: Carl Matthias Wise, Elsie Ober, Theodore Jan Prichard, Peter Bross.
Transportation and Protection of Models during Exhibition: Anton Johnson, E. E. Olson.

ARCHITECTS HOLD "JINX" PARTY

"A Torturing Device" was the subject of the Esquisse-Esquisse-Esquisse inflicted upon the Architectural Society meeting of Friday, the 13th of October. Twenty minutes' time was allowed for



the working out and rendering of a scheme; during which interval nothing was to be heard but the scratching of 3H pencils and the dripping of perspiration on the floor from the furrowed brows of the toiling designers.

"The notable examples of the mediaeval guillotine, the Puritan stocks and the pillories, the Spanish rack and screw—and the unsymmetrical hangman's noose" were suggested by the program as historical antecedents to this "device for the correction of erring, obnoxious, or moustache-adorned freshmen—and for relocating those who through a too acute command of the English language have strayed from their proper place of subordination by disagreeing with their professors."

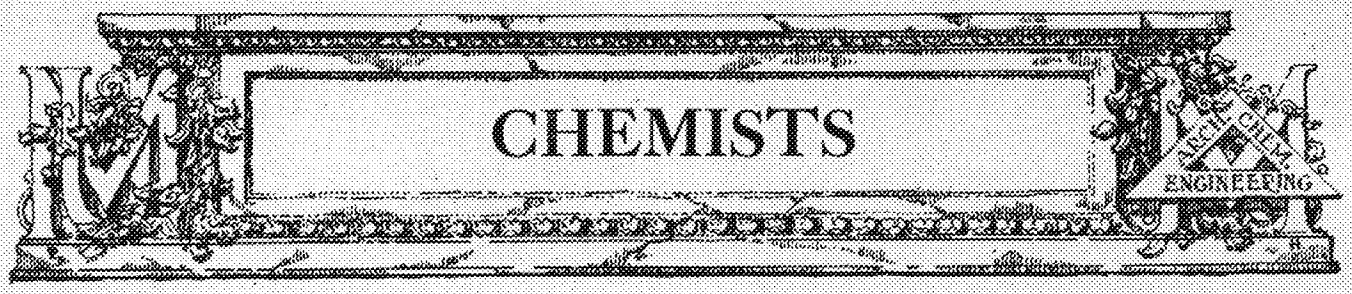
All too soon the twenty-minute period was at an end and the designs were collected and submitted to the jury. During the judgment the limp spirits of the company were revived by the injection of hot coffee, ham sandwiches, and cakes.

The foreman of the jury, Mr. Carl Matthias Wise, then gave criticisms on the designs, in a manner strangely reminiscent of other more serious occasions of a like nature.

First place was awarded Mr. Granville Smith, whose treatment of an eminently practical scheme was so thoroughly architectural that there were none to dispute its pre-eminence among the designs. (Note: Hem! hrm! G. W. S.) A pleasing feature of the arrangement was the provision for First Aid near the foot of the device in a neat burglar-proof safe.

Second place was awarded to Mr. William Woollett, whose scheme showed both ingenuity and a most commendable degree of cruelty in the tortures inflicted upon the victim.

The design of Professor Leon Arnal, despite a certain poetic quality in the conception superior to either Mr. Smith's or Mr. Woollett's, took only third place because of an almost total lack in it of true architectural feeling. A pathetic note was introduced into the composition by the use of a grassy grave, on the headstone of which might be read: **It killeth.**



A NEW FIELD IN CHEMISTRY

Possibilities of Chemical Manufacture, a Recent Course, Are Outlined for the Students

THE CHEMISTS' CLUB

Considering the abundance of sentiment against the formation of additional campus organizations, it is decidedly apropos for a new club to justify its existence. The number of activities already occupying the professional student's limited free time renders more than unnecessary any club without a definite mission. Moreover, if a technical organization can show no purpose in life other than a social one, it has no place on a campus as fully organized as ours.

The business of learning to be a chemist is a more complicated task than most of us ever suspected when we stood in line over at the Armory back in the days of "whenwasit." There are many sides to this science we are studying, and not of least importance are the historical and the personal aspects. Now, most physicists know that when Newton was struck on the head by the famous apple, he pronounced in a majestic manner the verity: $S = \frac{1}{2} g t^2$; but few of us future chemists ever heard about the somewhat similar experience that our friend, Robert Boyle of gas law fame, had while he was attending Eaton College. He had an exceptional chance to observe the working of the gravitation laws when, one evening, the entire ceiling of his room fell in, bringing down with it the furniture from above. He escaped injury but was nearly strangled with plaster dust. Neither do many of us know that Davy, who invented the miner's safety lamp, was not only a chemist, but a poet of considerable ability. He wrote one gem of literature describing the pleasurable effects of inhaling Nitrous Oxide,—the now well known laughing gas. Boyle and Davy are only two of the multitude of men whose work makes science more nearly perfect, and whose lives would be intensely interesting to study if we but had the time. A part of the program of the Chemists' club therefore consists of biographies of scientific men.

One of the most fascinating things about chemistry is the way it grows. It would be very interesting, sometime, to trace its growth through the various theories that have been held from time to time. We could start with the ancient philosophers who thought that the universe was composed of four elements, come on down to the alchemists and the philogiston theory, and end up with a summary of modern views. In this very fact that chemistry grows lies one of our biggest problems: how to keep up with the continual changes and improvements in modern industrial chemistry. There are many men in the Twin Cities who are qualified and, moreover, would be willing to discuss the branches of industry in which they are most interested. The nature of these talks would not be so technical but what we could all understand them. Perhaps the best way to learn about a process is to watch it, and trips through local plants will afford an excellent opportunity for observation.

The constitution and officers of such a club as the Chemists' Club are only details. The success lies in the hands of the members, who, after all, are the judges of the desirability of the organization. The club itself may not be important, but its meetings are.

NEW APPOINTMENTS TO THE FACULTY STAFF OF CHEMISTRY

W. S. Anderson, B. S., Bates College; R. F. Beard, B. S., N. D. Ag. College; E. B. Kester, B. A., Minnesota; Mary L. Morse, M. S., Michigan; Ruth E. Elmquist, B. A., Minnesota; N. S. Cassel, B. S., Minnesota; Leslie F. Stone, B. S., Minnesota, assistants in Inorganic Chemistry. S. F. Dorling, B. S., Minnesota; Esther E. Bauer, B. A., Minnesota; R. C. Fuson, M. S., California, assistants in Organic Chemistry; and Minerva Morse, M. S., Minnesota, Shevlin Fellow.

The Periodic Law

The property of being hungry is a periodic function of a chemist's stomach.

Avogadro's Law

Equal number of chemists in the hot-air state yield the same number of words.

ENGINEERS BACK STADIUM

(Continued from page 9)

Team 4, Nils Johnson, captain. Carl Odquist, James E. Darrel, George Schaller, Murray Lampher, Anton Johnson.

Division IV. Harley Langman, commander. Team 1, Leonard Mabbott, captain. Hiram Beck, Warren Carlson, J. R. Furber, Roy V. Johnson, Clarence Teal.

Team 2, Kenneth R. Ross, captain. G. B. Gilbertson, N. S. Collis, Charles Blodgett, Clifton Rousseau, Robert Erskine.

Team 3, Walter Wilson, captain. John Wagner, Edwin Bergquist, Clarence Vels, Lawrence Holder, Rolf Norman.

Team 4, Niles Thompson, captain. Wendell Cutliff, Albert Morse, Kenneth Bros, Hilder Bergman, Arthur Mindrum.

Division V. Harold Peckham, commander. Team 1, Sheldon Hibbard, captain. E. V. Brossard, Elmer Eige, Dan Thorne, C. F. Olmstead, R. C. Ascher.

Team 2, Lee Amidon, captain. Arthur Sear, Sidney Acker, Glenn Larson, P. G. Swanson, Ben Bros.

Team 3, Karl Keiser, captain. Arthur Gilstad, Edward Stauffacher, R. Gross, Art Olson, F. C. Kiesner.

Team 4, Phil Richardson, captain. M. W. Hart, Ted Walder, Welhani Miller, Swan P. Berg, Glenn Meader.

Ellsworth Johnson, C. E. '22, of Minneapolis, is with the Berger Mfg. Co., sheet metal and culvert manufacturers.

Word has come that E. S. Gould, C. E. '20, 315 Ontario street S. E., Minneapolis, is now calling a newcomer "Junior."

Ray R. Sweet, E. E. '21, is chief engineer in charge of the large new radio station at the Oak Grove Hotel, Minneapolis, which is sending out radio telephonic over the signature WLAG. This station is one of the six largest broadcasting centers in the United States, and its concerts have been heard in New York, San Francisco, and Canada. President Coffman not long ago delivered an address on public education in Minnesota which was broadcast by this station. From Red Wing, where the address was amplified at the county fair, and from private receivers in various places, felicitations have been coming in on the quality of the transmission, as well as the excellence of the speech.

DAYLIGHT ILLUMINATION.

The angle of refraction being equal to the angle of incident, it is a simple matter to determine the correct angles to use in manufacturing glass which will give good illumination. But for proper industrial plant illumination, there is more to be considered than mere deflection of light. The direct beam of light must be eliminated in order to prevent sun glare, which is objectionable on account of its causing heavy shadows and strong contrasts which decrease the efficiency of employees and necessitate the use of shades which in turn reduce the light to such an extent that daylight illumination any distance from the light source is not sufficient. Therefore, in order to produce a glass which when used in the windows of industrial plants will produce as near to ideal illumination as possible, we must first eliminate the direct rays of the sun by deflecting the light to the ceiling and side walls which re-deflect it back to a distance 25 to 50 feet from the window throughout the entire working area. To accomplish this we have scientifically designed a type of glass which is named "Factrolite."

Factrolite consists of 30 ribs to the inch, running at right angles, forming 900 pyramidical prisms or 3,600 light deflecting surfaces which completely disintegrate the direct beam of light from the sun. Furthermore, the depressions in the surface of Factrolite are so slight that the accumulation of dirt and dust is minimized and can be perfectly cleaned with an ordinary dry scrubbing brush. Incidentally, the cleaning of windows is most important for keeping up production and increasing the efficiency of any industrial plant and should be given more consideration in plant management.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.

220 Fifth Avenue,

St. Louis. New York. Chicago.

MINNESOTA BY-PRODUCT COKE COMPANY

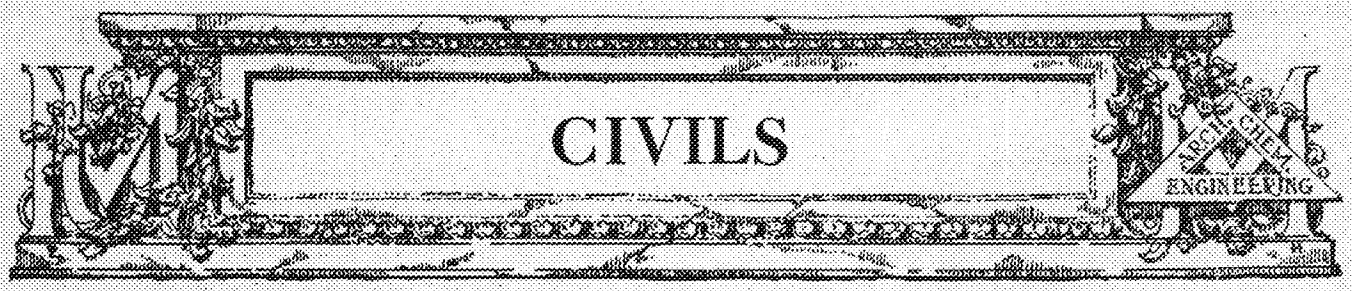
(Continued from page 12)

numerable number of dyes, colors, paints, varnishes, resins, cosmetics, medicines, insecticides, disinfectants, etc. The working up of tar produces all of the products and results credited to the benzol family and in addition being used extensively as a fuel, binder and surfacer in road building, fireproofing, electrodes, waterproofing agent, smokeless powder, etc.

Of the several products recovered, possibly coke is the most important, at least from the standpoint of remuneration. After carbonization it is pushed from the oven, water quenched, air dried, crushed and screened into the several popular sizes and grades as: run of oven, manufacturer's run of oven, foundry, egg, stove, nut, pea and braize. The latter is nothing more than the so-called fines, under one-half inch, and is used for boiler fuel with a great degree of satisfaction.—it contains less volatile matter than anthracite and is high in fixed carbon.

I failed to say that foundry coke is made from higher quality coal, or of a different mixture of coals than are other cokes, such being necessitated by the stringent specifications set up by founders and users of metallurgical quality cokes.

(Continued on page 26)



AMERICAN SOCIETY OF CIVIL ENGINEERS

The establishment of the American Society of Civil Engineers on the campus as a student chapter has been so favorably received by the students that their support has assured the society of the foundation of such a chapter's success. The students have realized the importance of affiliation with the society, to the extent that practically every junior and senior civil has become a member of the student chapter. The overtown practising members of the American Society of Civil Engineers have taken a fatherly interest in the student organization. Help from them may be expected in the planning of many programs for the winter meetings. Several prominent engineers of the organization have assured the students that they will gladly speak from time to time on practical subjects familiar to them and interesting to the students.

The activities of the student chapter were started this fall with a visit by John H. Dunlap of New York City, national secretary of the organization. On the morning of Oct. 17 he addressed the assembled students of the department of civil engineering in the engineering auditorium. He outlined the history and aims of the society since its foundation in 1852. He also spoke of its high ideals, stressing the value of sound character and a stainless reputation to the practising engineer.

Dean O. M. Leland spoke in a similar manner at the banquet given by the society in honor of the faculty members on Thursday evening, Oct. 19. He said that the engineer's stock in trade is his "good reputation and moral character." There were places for eighty. Every one there, including our two women members, enjoyed a versatile program. A four-piece orchestra of members furnished the music during the courses, and for the singing afterward. Two vaudeville skits were presented: one by the Arabs, a darktown dancing act, and the other a Scandinavian dialogue, by Al. Johnson and Elmer Nelson, members of the society. The latter sang burlesqued verses on every senior present. The party then officially ended but many of the fellows remained to sing the songs that were made popular during the civil camp at Cass Lake.

Immediately following the banquet, plans were made by the officers for a membership campaign in the sophomore civil class. Students in the sophomore class, as well as the upper classmen, now are eligible for membership. The granting of an emblematic pin to the student chapter by the American Society of Civil Engineers has acted as a stimulus to the securing of members, and memberships up to this time have been practically unsolicited. Throughout the organization such a spirit of good-will and co-operation exists that a successful and interesting year is inevitable for the active members.

The men who will lead the organization this year are: Orville H. Hosmer, president; Lloyd Mitchell, vice-president; Arthur Zimmerman, treasurer; George O. Guesmer, secretary. Frank Christlieb is chairman of the entertainment committee; B. K. Curry is manager of publicity; Nels Johnson of programs; Aubrey Leonard of membership.

SENIOR CLASS NOTES

The senior civils finally came into their own. At the annual election of officers they carried everything. No one seems to know how it was done and if one asks a civil he replies with the old saying, "You can never keep a good man down." The electricals have practically run the 1923 class up to the present year so that the civils take great pride in telling that the present officers of the senior class are: Hibbert Hill, president; Lloyd Peck, vice-president; Edward Dindorf, Secretary; James Darrell, treasurer.

We have noticed that quite a few of the senior civils (not mentioning any names) have lost their fraternity pins, but according to a notice in a Minneapolis newspaper, Paul DeFreece went them one better on his return from camp.

Someone asked Mike Mitchell, our representative on the football team, if he was coming back next fall to play football. Mike replied that he did not know about coming back to play football but that he would probably be requested to come back and wrestle with concrete theory.

Art Zimmerman has been appointed manager of intramural athletics in the engineering college. Things should hum now because everyone knows that "Zim" certainly managed the camp baseball team with great success at Cass Lake.

"Hib" Hill returned to the campus Thursday after being A W O L for about a week. He said that he was at a convention in Ann Arbor but we all know that conventions do not last more than three days.

Professor J. I. Parcel has returned to the college after a year in Europe. He has promised us an article for the next issue giving the details of his trip.

Professor Cutler recently attended an American Railway Engineering Association committee meeting on the Economics of Railway Location in Chicago.

ELECTRICALS

A. I. E. E. MEETS

The first meeting this year of the Minnesota section of the American Institute of Electrical Engineers was held at the Engineering Auditorium Monday, September 25. The topic discussed was "Fuel." Mr. F. H. Rohl, of the Pittsburgh Coal Co., gave an address on "Bituminous Coal"; Mr. Max Toltz, of the Toltz Engineering Co., gave an address on "Peat." There was an address on "Lignite" and a moving picture. These meetings are conducted monthly by the Minnesota section, but members of the student branch are also welcome. The meetings are very well worth while attending.

The second week of school marked the beginning of all laboratory work in the Electrical building. The sophomores began dodging girders and pulling switches in the basement. The juniors began their first motor and generator experiments, the first one being an inspection of a machine. The first thing they learned both in the classroom and the laboratory was to never open the field on a motor when there is current through the armature. The seniors began grappling with the mysteries of A. C. with its admittance, conductance, and resonance.

A communications laboratory with equipment of telephone, telegraph, and radio apparatus has been established on the second floor of the building. The course in radio offered by Prof. Jansky has proven especially popular, 50 per cent more men than expected registering.

STUDENTS GET WORLD SERIES NEWS BY RADIO.

The armory was the headquarters for the World Series fans. Snyder's place was outdone by Captain Watson, who installed a radio set in his office to get the World Series news. The inning reports were received as broadcast by radio-telephone from the Journal office.

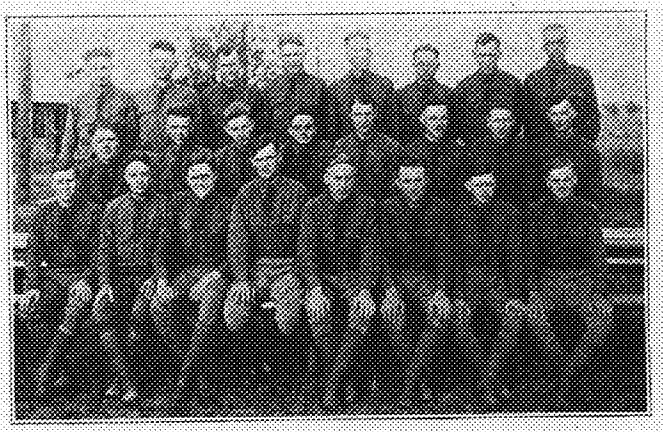
Captain Watson strung an aerial from his office to the armory tower. He used an Army standard set No. 54 substituting a VT-1 tube in place of the crystal detector. This VT-1 detecting tube took 20 volts grid potential and four volts on the filament. He coupled this inductively to a two-step amplifier consisting of two more VT-1 tubes, the first carrying 20 volts and the second 10 volts grid potential. This amplifier was coupled the magna-vox circuit, which contained a VT-2 power tube carrying 150 volts grid potential, and the magna-vox amplifier or loud speaker.

This hook up was satisfactory for the short distance required.

The student branch of the American Institute of Electrical Engineers, the only organization on our campus in which membership is limited to those students who are studying electrical engineering, is formulating plans for a big year at Minnesota. The student branch takes its place with the other departmental associations in the college and maintains a position among the numerous student activities which identifies it as one of the greatest working factors in keeping the student in touch with the growth and development of his chosen profession.

The faculty in the electrical department are solidly behind the organization and have already rendered worthy service in getting things started right this fall. A new plan for holding the regular meetings has been adopted this year. Meetings will be held in the Minnesota Union instead of the Engineering Auditorium and will begin at six o'clock. A dinner at a very nominal cost will be served. It is hoped that this change in procedure will make it possible for every student to avail himself of those opportunities which the American Institute has to offer.

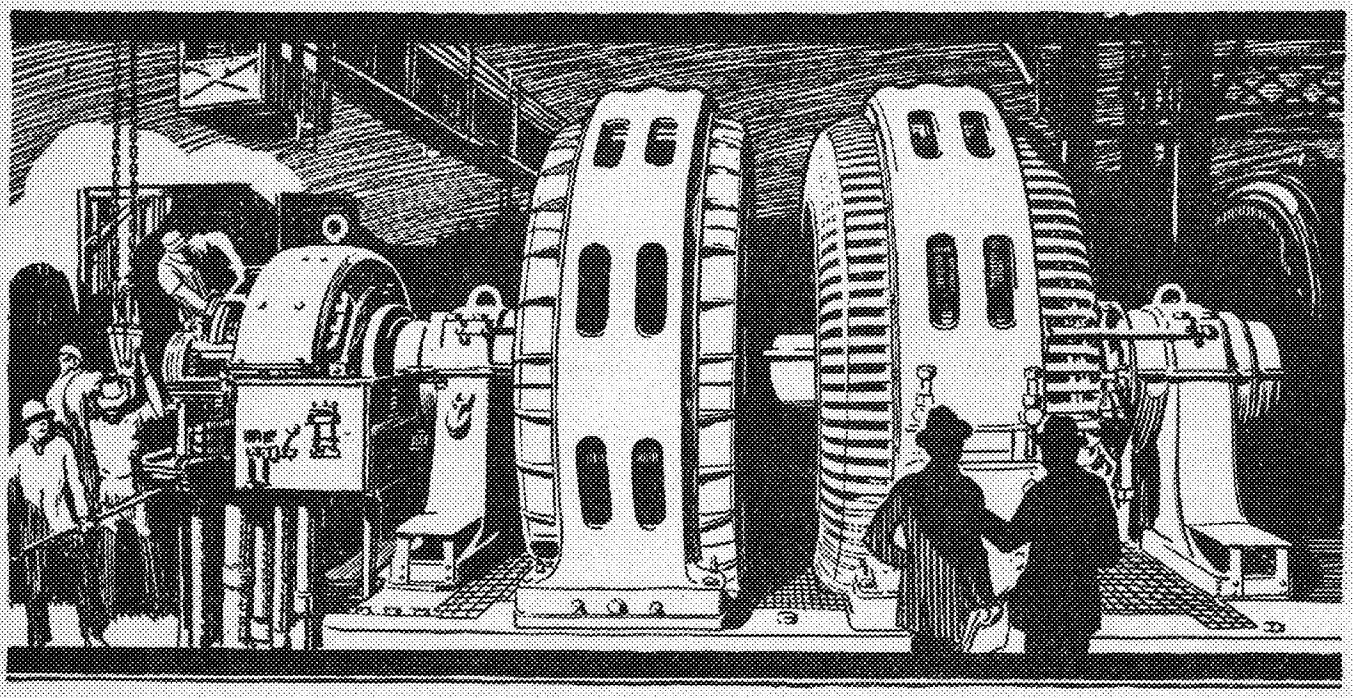
Roy Olson, the chairman of the student branch for the coming year, and Clifford Sampson, the secretary, along with a committee chosen from the various classes, have made extensive plans for the coming year.



The Signal Corps Camp.

The present senior class is going to furnish the country with a number of eminent politicians if the present indications are to be given any value. At the senior class election the civils brought forth a political steam-roller that would make Tammany or Penrose blush for shame. In fact the whole thing had the ear-marks of a Townley organization. Who played the role of boss is still anybody's guess.

Much interest is being shown in South Dakota concerning the proposed question of a state hydro-electric plant, which will be voted upon by the people in the November election. Engineers state that the Missouri River is capable of producing 500,000 horse-power for a hydro-electric plant to furnish electricity for the entire state. November election returns will be watched with keen interest.



Real Service Must Be Engineered

Many of the men whose names are writ large in engineering history are design engineers; men like Westinghouse, Lamme, Stanley, Hodgkinson, Tesla, Shallenberger. Their inventions have the quality of usefulness, of reliability, of productability; which is an involved way, perhaps, of saying that they have the primary requisite of all really great inventions: *Serviceability.*

Engineering history abounds in instances of near-genius that produced no product, and of great developments that never reached completion; and most of these instances are explained by the lack, somewhere in the system, of that ability to give real Service.

Service, in a machine or a system, or wherever you find it, is not there by accident but because it was incorporated by men who understood what was required and knew how to provide it.

Much more is required of the designer than facility in calculation and mastery of theory. He must have first hand and thorough familiarity with manufacturing operations and with commercial and operating conditions. It takes more than mere ingenuity and inventiveness to design apparatus that will be really serviceable and will "stay put."

The design engineer, in the Westinghouse plan, is responsible for the performance of the finished product. He cannot possibly have the proper understanding of operation unless he operates and tests, unless he spends time and thought in investigation and study, not in the laboratory or drawing room, but right on the operating job. Here, most of his ideas will develop; and here he will see and prepare for all the different things which the product will later have to encounter. Then when he comes to put his creations on paper, his calculations will be necessary and helpful to check the conclusions which he has reached, and this right use of them requires training and a high degree of understanding. This proper balance of the physical and mathematical conception of things is what constitutes engineering judgement.

It should be thoroughly understood that the primary function of the design engineer is the conception and the production of new or improved apparatus, and familiarity with the practical is essential to the proper discharge of this duty.

It is this view of designing that makes this branch of Westinghouse engineering so important, so effective, and so productive of real developments.

MINNESOTA BY-PRODUCT COKE COMPANY

(Continued from page 22)

Plant Is Large

Any of the cokes mentioned are, however, low in moisture, ash, volatile and high in fixed carbon, which make them not comparable with, but superior to, the best grade of anthracite coal and are of such nature as to permit of a greater recovery of useful heat than by any other solid fuel, besides covering a greater range of usefulness.

A plant that extends along the Great Northern tracks practically from Snelling Avenue to Lexington, that daily requires from 800 to 1,000 tons of coal, a place where visitors are taken for a promenade over a battery of ovens—some sixty-five of them—which are kept at a temperature of about 1,800 degrees F. within the coking chamber: such is the plant of the Minnesota By-Product Coke Company.

To insure an absolute uniformity in the quality of their products, this company uses several grades of coal, some high in volatile and the balance of lower volatile content, the ratio in which they are mixed being dependent upon numerous chemical analyses which are made at frequent intervals, both upon the coal and the final products.

Two Kinds of Coal Used

The plant is served by both the Great Northern and the Northern Pacific, and immediately upon receipt of cars from either road they are weighed and set upon either the High Volatile or the Low Volatile track to await their turn to be dumped. The coal is dumped into hoppers beneath the tracks, from which it is conveyed to the top of the breaker house, where it falls into a Bradford breaker,—an enormous machine on the order of a huge horizontal churn. The coal is crushed to about pea coal size, and the slate, rock, track spikes and whatnot are sloughed off to one end so that there will be virtually no foreign matter in the coke, while the coal falls into steel bins directly below. There are two bins for high volatile coal and two for low, each one of which is fitted with a metering device at the outlet at the bottom so that the amount of coal which will be deposited on the belt conveyor leading from each bin can be regulated. These conveyors (both high volatile and low) discharge into what is known as the hammer mill (breaker)—a machine worthy of some special attention.

It crushes the coal very fine (75 per cent through a ⅛-inch screen) and serves to mix the two grades very intimately. The mill consists essentially of a huge drum with deep peripheral grooves, and the hammers,—short, stubby bars of manganese steel,—loosely pivoted at one end by being pinned into the grooves of the cylinder. The other end of each hammer is free to swing at will, their free ends swinging above a concentric steel screen. The de-

(Continued on page 29)

MECHANICALS

A. S. M. E. NEWS

The University of Minnesota section of the American Society of Mechanical Engineers held its first meeting of the year on Saturday, October 21. A record crowd was in attendance.

President Olmstead opened the meeting and presented to the members the aims of the society, and a tentative outline of the plan of activities for the coming year. In addition to the many prominent speakers that it is the custom to have on the program at its meetings, the section will stage a banquet this winter and a picnic in the spring.

The U. of M. section of the American Society of Mechanical Engineers enjoys the distinction of being one of the most active and progressive sections in the United States. Last year the section membership was about 90 per cent of the total enrollment in the mechanical department, and this year a 100 per cent membership is the goal.

Professor J. J. Flather, first speaker on the program, endorsed the section's activities and stated the benefits to be derived by becoming a member of the A. S. M. E. when a student, and by association with other men in the department. Professor Flather stressed the value of activity of the section, and cited instances in which the local section had attracted praise for its record in this connection. He finished his address by urging every member to become a regular reader of the A. S. M. E. Journal, recommending it as the most valuable technical magazine that the students could obtain.

Professor Rowen was the next speaker, and he gave a very interesting talk on the value to the student of expanding his activities to include the acquaintance and association with men outside of his own field. He advised the members not to restrict their minds to their technical work, but to read about and discuss current world political and social problems. Professor Rowen pointed out the importance of many seemingly unimportant and neglected propositions that in reality called for the serious consideration of every citizen. He stressed the importance of engineers in particular interesting themselves and taking an active part in world affairs.

The local section has been promised an illustrated talk on engineering conditions in the Near East by Professor Shipley, who has recently returned to the mechanical department from Constantinople, Turkey.

For the past two years, Professor Shipley has been director of the engineering department of Roberts College, in Constantinople. He is now professor of Machine construction and superintendent of the mechanical department's shops.

A. S. M. E. officers and committees for the year 1922-23 are as follows:

Executive

Professor J. J. Flather, ex officio; C. F. Olmstead, president; R. C. Ascher, vice-president; G. M. Larson, secretary; H. R. Langman, treasurer.

Program

H. E. Peckham, chairman; K. W. Keiser, J. A. Anderson, (Sophomore to be appointed).

Social

A. W. Sear, chairman; A. Gilstad, E. V. Brossard, E. L. Stauffacher.

Membership

L. L. Amidon, chairman; W. A. Thomas, S. H. Acker.

Journal

F. E. Copeland, chairman; D. W. Dale.

Mechanicals in Graduate and Research Work

Several graduates of the mechanical department have returned this year to perform research work and earn the degree of Mechanical Engineer.

C. F. Olmstead, of the M. E. class of '22, was awarded one of two fellowships offered by the Engineering Experiment Station for research work. These awards are made on the basis of high scholarship and engineering ability. Mr. Olmstead's work in this connection will consist of a "Study of Heat Transmission Through Building Materials." It will involve the design and construction of a "cold room." The work is under the direction of Professor Rowley, head of the department of experimental engineering. A bulletin will be published on this work upon its completion.

"Oil Burning Furnaces for Residence Heating" will be the subject of the theses of C. F. Olmstead and John Wallfred of the M. E. class of '20, who will experiment jointly upon the various oil burners on the market. Study and comparative tests will be made upon these burners and possibly burner design, depending upon the results of experiments.

Arthur W. Kumm, of the M. E. class of '22, is majoring in power plant engineering. His thesis will be "A Survey of Central Heating Plants in Minnesota." The work, which will consist of a determination of the costs of installation and operation of the several central heating plants in Minnesota, is under the direction of the "League of Minnesota Municipalities."

MINNESOTA BY-PRODUCT COKE COMPANY

(Continued from page 26)

sired fineness of pulverization is secured by adjusting the distance between the outer ends of the swinging hammers and the screen plate below. The drum is rotated by means of a 300 horsepower motor.

After the final breaking and mixing, the coal is conveyed to the charging bins which stand above one end of the battery of ovens, filling the larry car which runs on the top of the ovens.

Ovens In One Unit

The entire battery of ovens is built as one unit, the whole being a silica brick structure some forty feet wide, fifteen or twenty feet high and approximately 250 feet long. Each oven—of which there are sixty in the main battery—is eight or nine feet high, a foot and a half wide and 37 feet long on the inside; each will hold a charge of about 12.7 net tons, and all are heated by a system of gas-fired flues, there being a row on each side of every oven. A regenerative principle is used in firing these, for only one-half are lighted at a time, the other half being used to preheat the air for combustion. Every half hour the process is automatically alternated.

When an oven is to be charged the larry car comes over from the charging bins laden with some thirteen tons of coal; four lids are removed from the oven, and the coal is dropped in. Then a ram which has come into position at the end of the oven pushes a long leveling bar in through the top of the oven door and levels off the charge of coal so as to facilitate the egress of the gas. The oven is then sealed up and the damper connecting it with the gas main is opened.

After the proper time has elapsed, the damper is closed, the doors at each end of the oven are opened, the ram again takes position at one end while an all-iron coke car ("hot car") comes up at the other end; whereupon the ram forces the flaming redhot coke out of the even and onto the car. The coke is then quenched, dried, broken, and screened into popular sizes ready for shipment to the trade.

Gas Is Cooled

The gas that has come off meanwhile has been pumped,—not forced by the pressure generated in the oven, first through a tar collector, and then into the primary coolers in the by-product house, where it is cooled to twenty degrees centigrade.

Much of the ammonia is removed at this point, being pumped out as aqueous ammonia with the condensed water vapor. The tar which has condensed is then conveyed to a tar separator. The next apparatus (tar extractor) removes the tar which is present in such finely divided particles that it will not readily condense. The gas impinges against numerous baffles which cause it to collect into drops.

After thus being freed of all traces of tar, the gas finds its way to a saturator where ammonium sulphate $(NH_4)_2SO_4$ is formed, the latter being extensively used as a fertilizer. The formation of this product is caused by bubbling the gas through a dilute solution of sulphuric acid, the acid uniting

(Continued on page 32)

TECHNICALITIES

AN ENGINEERING EDUCATION,
or Ten Nights at the Track.

My car moved slowly along the dark, quiet road. The moon shone brightly down upon us; the weird call of a night bird could occasionally be heard; the lake, by whose margin the road ran, shimmered and glittered under the rays of the full autumn moon; the scene alone was enough to make one feel the delicious thrill of romance.

By my side was a sweet, palpitating bit of feminine loveliness. Tiny she was, and dainty as a doll's teacup. The light of the moon shone upon her entrancing face, and gave to it the beauty and grace of the heroine of a fairy tale. The moonbeams sparkled in her large, deep, azure eyes, the soft curve of her cheek held the delicate tints that nature alone can give, and her red lips just showed a line of perfect white teeth between their Cupid's Bow.

When she spoke to me she would rest her hand lightly upon my right arm, and gaze appealingly and trustingly up into my face. At my most unimportant statement about myself she would appear overcome with awe, and exclaim, "How Won-der-ful!"

I could resist no longer. I slipped my right arm around her, and drew her to me. She snuggled close, and gave a tiny sigh. Her head rested upon my shoulder, and the faint perfume of her hair made my nostrils quiver. I drew a long breath. A new radiance seemed given to the world.

We drove on for several minutes. Her soft hair brushed my cheek. I glanced down, and found she had tipped her head back, and was looking up at me. She drew her lips a trifle together into an alluring rosebud. As if drawn by a magnet, my head bent down. Our lips met. I could feel her hot breath on my cheek, and her warm, moist lips against mine.

After a moment her clear, sweet voice broke in upon the stillness.

"Does oo love me?" she gurgled.

"Dearest!" I replied reproachfully.

She paused a moment, rested her head upon my arms, and gazed soulfully up into my eyes, and murmured, "Then let's go eat."

Into the valley of debt, rode the 1,500.

He: I love you because you are the sweetest and most beautiful girl in the world.

She: And I love you because you are so frank and truthful.

An Irishman going through a cemetery, read on a tombstone, the words, "I still live."

"Begorra," said Pat, "if I were dead, I'd own up to it."

Calculus Problems: How much grass can a cow eat when tied to a rope 18 feet long?

Shark: "Which end of the rope was the cow tied to?"

In C. E.-12: What was one of the greatest obstacles in the building of the Panama Canal?

A Soph: Dirt.

NEW VERSION.

Q. Why does a chicken cross the road?

A. Because it's too far to walk around.

Mr. Kirk: Name a liquid that won't freeze.

27 Frosh together: Hot water.

Prof.: Time flies.

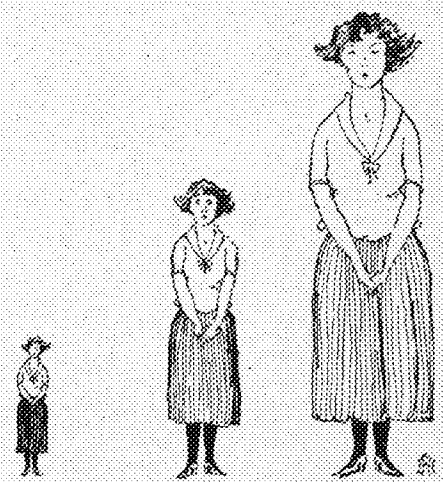
Stud.: I can't, they're too quick for me.

Prof.: A fool can ask questions a wise man cannot answer.

Student: Ah, that's why I've been flunking your quizzes.

She: I'm simply wild about a yacht.

He: Er, how do you act on a motor boat?—Brown Jug.



VITAL STATISTICS.

In spite of the assertions of the Daily, and also other authorities too numerous to mention, the Technolog has discovered that bobbed hair is not going out of style. Our first count on April 26, 1922, gave 10.73 per cent of the coeds with shorn locks. A census of the campus on June 7 shows 23.26 per cent of the coeds had bobbed hair. A final complete and exhaustive count on Oct. 11 shows that the number had increased to 29.01 per cent. We believe these are the only accurate figures on the subject which are in captivity.

FRESHMAN THEME.
Beautiful Buildings I Have Seen. No. 1, Our Armory.

On the campus of the University of Minnesota, there stands an imposing building. Every one who enters it is imposed upon. There is a rumor that the original builders of the University planned to have the Ag. college on this campus, but finally decided to keep the stock away from the temptations of the vast and horrid city, and so the Armory was turned over to the army. It is an excellent place to drill, as it teaches the officers to manoeuvre the troops dexterously. After drilling a company in there one winter, any of the officers could march an army across Niagara Falls, in column of squads, on a tight rope, and not lose a man. They play athletics here is this building too, but not many people know it because when they get a basketful, or etc., team inside the building there isn't any room for anybody else.

Architecturally speaking, this edifice is among the most classic in America. It is an accurate reproduction of the ruins of Ancient Grease. A new roof was put on our Armory last spring. It is guaranteed to last 50 years unless someone will design a new building to fit the present roof, the legislature refuses to build a new Armory until the new roof wears out.

AN ODE OF GRIEF.

"East is East and West is West,
Never the twain shall meet."

He looked at her passionately, adoringly; and why shouldn't he? She glanced coyly, shyly across at him, a delicious blush mantling her cheeks.

Ah! he is a perfect specimen of virile young manhood, with clean shaven face and resolute chin topped by a magnificent growth of hair rivaling the best patent leather pumps of Stetson.

But she! magnificent creature, her dainty curves and well formed silk-clad calves, declared her irresistible charm.

What a shame that two such perfect creatures can never meet, for he is an Arrow Collar and she a Luxite hosiery girl on opposite sides of a street car.

PAGE SOLOMON.

Citizen (thunderously): What are you doing over there?

Neighbor: Beating up my wife.

Citizen (excitedly): May I come over and see how it's done?

—Orange Owl.

AFTER THE DANCE.

"Darling, can anything ever come between us?"

Eavesdropper (to himself) "Impossible."—Penn State Froth.

THE FABLE OF THE BLUE BLOOD WHO DIDN'T GET TO FIRST BASE.

By Flying Fox.

With profound apologies to George Ade.

Once upon a time there was a Coed named Gladys, who was known as a Hotlooker. She made the Queen of Sheba look like one of the Gold Dust Twins. She did not belong to any Sorority on account of being so good-looking.

On her List of Callers was an Intellectual Bankrupt named Oswald. If his Grey Matter had been Three in One there would be enough to Grease the Hinges on a Pair of Spectacles. He was left-handed in both Feet and could not Walk down the Street alone without getting out of Step with himself. Some People even went so far as to say that he got in his own Way. Nevertheless he was the King Bee because he owned a Speerless Sensitive Six and belonged to A Fraternity.

When he went calling on the Queen, she met him at the Door with her Wraps on and gave him the Orders for the Evening. They were going to the Metropolitan.

He suggested the State but he might as well have suggested going out in a Rowboat to handcuff a couple of Bobolinks.

After coming out of the Show she would pull the Old One about being Hungry and suggest hanging on the Nose Bag at some Chop House.

He laid down an X to pay for the Mushrooms and Almonds and Etc. and got back Carfare.

She let him accompany her as far as the Screen Door and even went so Far as to let him hold her Hand while saying Goodnight.

Next A. M. she told the Hens at the P. O. about spending the Evening with a Blind Herring and being bored to Death, but she was Stringing him along in hopes of getting a Bid to the Phi Nu U Formal, but Heaven knows, she hated to Dance with him because he trod all over her Wheelbase—Bla, Blah.

It so happened that attending this same Knowledge Factory, was a Plebeian named Oscar. It seems that Oscar had never been rushed by the Phi Nu U, because he ate Dinner at Noon and drove a 4d and wore the same Shirt two Days in succession. He was an ordinary 6⅞ Ostrich, who preferred standing in Line at the Food Foundry of the Men's Union to sipping Tea at the Soak Thee. He Smoked a Pipe that resembled a Saxophone. When he lit it up it smelled like Someone was shoeing a Horse. As a Society Bud, he was the Rat's Rubbers.

Nevertheless he would call on the beautiful Squab and take her for a Walk down the River Road or, perhaps, drop in at the Twobit Movie around the Corner. After taking her Home, he would suggest that she rustle up a little Grub, as the Night Air gave him an Appetite. After the Dishes were cleared away they would put "Nobody Lied" or some other late Hymn on the Victrola and then roll up the Rugs or perchance they would park on the Davenport and pull some Mushy Stuff.

Next morn she would tell the Bunch about her Wonderful Sheik.

Moral: Let the other Guy spend his Dough on her.

Blub: I hear you are working in the shirt factory now.

Glub: Yes.

Blub: Why aren't you working today?

Glub: Oh, we are making night shirts this week.—Spider Webb.

Father to Coed (after examining her expense account): "Do you think silk stockings are absolutely necessary?"

Daughter: "Certainly—up to a certain point."—The Humbug.

The Domestic Labor Question.

"Hello! Is this the woman that wanted the lady to wash tomorrow?"

—Michigan Gargoyle.

He: Your trip must have been fine. I'll bet you saw a lot of queer people.

She: Yes, but after all there's no place like Home.—Pelican.

MADAME!

He: Why don't you like my brother?

She: He's always so ossified!

He: Why, when did you start using the broad a?

—Carolina Tar Baby.

She: Have you got a dress suit?

He (hopefully): Why, yes.

She: Good! I'd like to borrow it for the fellow I'm going to ask to our house formal.—London Punch.

Miss Tillie Jones,
Chipmunk Center, Minnesota.

Dear Tillie:

I am now a enginear at the University. Gee, I feel graud. I was going to to be a Doctor, but a guy here told me Anatomy was a stiff course, so I changed my mind. The thing that decided me to be a enginear is because the enginear bldg. is the nearest to the car line and I can go down town and etc at night without much trouble.

I ain't met but one girl here. I met her at a Sunlite. Them things is dances before supper. I went home with her afterwards, and she says, "When do we eat?" I says, "We had supper at 6 P. M. at our boarding house, when do you?" She says, "Oh, anytime." A minute later we was passing a place called the Oak Tree. Before I went there the first time I thot it was an office for a Lumber Yard, but I found it was jest another place to eat, **only** costlier. As we was passing this here place, she started to go in. I says, "Gosh, do you live here? She looked **at me kind of funny** and then started on down the street. Funny she didn't know where she lived.

Say, are you planning to come down to the city soon? I was talking to a Soph. about you, and says, "I wisht I could see her again soon," and he says "You'll see her after midquarters." I wonder how he knew. If it is true, I sure hope those midquarters happen soon, whatever they are, because they must be fine if they'll bring us together again.

Beancoap love,
HORATIO.

P. S. How do you like my French?

Art: Here comes a plucky girl.

Bert: How do you know?

Art: Look at her eyebrows.

—Sun Dial.

MINNESOTA BY-PRODUCT COKE COMPANY

(Continued from page 29)

with free ammonia (NH_3) in the gas. Before the gas enters the saturator it is passed through a reheater where the temperature is elevated from about 30° C. up to about 65° C., largely for the purpose of decreasing its relative humidity, thus making it susceptible of picking up surplus water from the mother liquor contained in the saturator. Sixty degrees Be' sulphuric acid contains, roughly, 23 per cent water, hence if this water were not gotten rid of the saturator would soon become too dilute.

The weak ammonia liquor deposited in the foul gas mains, primary coolers, etc., is collected into a storage tank which supplies an ammonia still. There the free and fixed ammonia is reclaimed from the weak liquor, and is converted either into salable concentrated liquor, or into free ammonia which is passed into the gas main before the saturator, so that additional ammonium sulphate may be produced.

Last By-Products

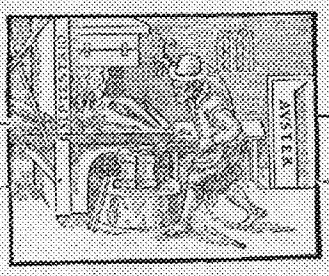
The gas, being thus freed of tar and ammonia, goes to the final coolers, where it comes into intimate contact with the recirculated cooling water which condenses out the naphthalene, the latter being reclaimed and sold.

Benzol, toluol and solvent naphtha are the last to be removed, and this is accomplished by washing the gas with a petroleum oil of high boiling point, the by-products being separated from the oil by distillation. This separation and purification is accomplished in the benzol building,—a clean, light and interesting place, but dangerous for an absent-minded person with the "tobacco habit."

All that remains to be done to the gas is to meter it and pump it to the city. Metering is simplicity itself, the principle being as follows: In a vertical straight section of pipe two thermocouples are installed approximately six feet apart, and between them is an electric heating coil which has an integrating wattmeter in circuit. The temperature difference between the two thermocouples is automatically kept constant at two degrees; consequently, variations in flow of gas will require corresponding variations in the current through the heating coil, so that a wattmeter can be calibrated to read in cubic feet of gas. Pumping is done by means of a Nordberg poppet valve engine, driving an impeller pump connected to an 18-inch main, and a rather high pressure for gas is maintained, four to six pounds.

The whole plant is a model of co-ordination and efficiency. No known means of heat conservation has been neglected, and the abandon with which indicating, recording and integrating temperature and pressure regulating devices of various sorts has been installed is amazing. Pages might be written about it, as might also be done about the precautions taken against accident and breakdown. Never a P. T. U. is A. W. O. L., and they are too well controlled to start trouble. It is a plant that every engineering student should see, and the management has kindly consented to allow any student who is genuinely interested to go through the works.

FROM GILBERT'S



DE MAGNETE

"WORD MONGERS" *and* "CHATTERING BARBERS"

"Word mongers" and "chattering barbers," Gilbert called those of his predecessors who asserted that a wound made by a magnetized needle was painless, that a magnet will attract silver, that the diamond will draw iron, that the magnet thirsts and dies in the absence of iron, that a magnet, pulverized and taken with sweetened water, will cure headaches and prevent fat.

Before Gilbert died in 1603, he had done much to explain magnetism and electricity through experiment. He found that by hammering iron held in a magnetic meridian it can be magnetized. He discovered that the compass needle is controlled by the earth's magnetism and that one magnet can remagnetize another that has lost its power. He noted the common electrical attraction of rubbed bodies, among them diamonds, as well as glass, crystals, and stones, and was the first to study electricity as a distinct force.

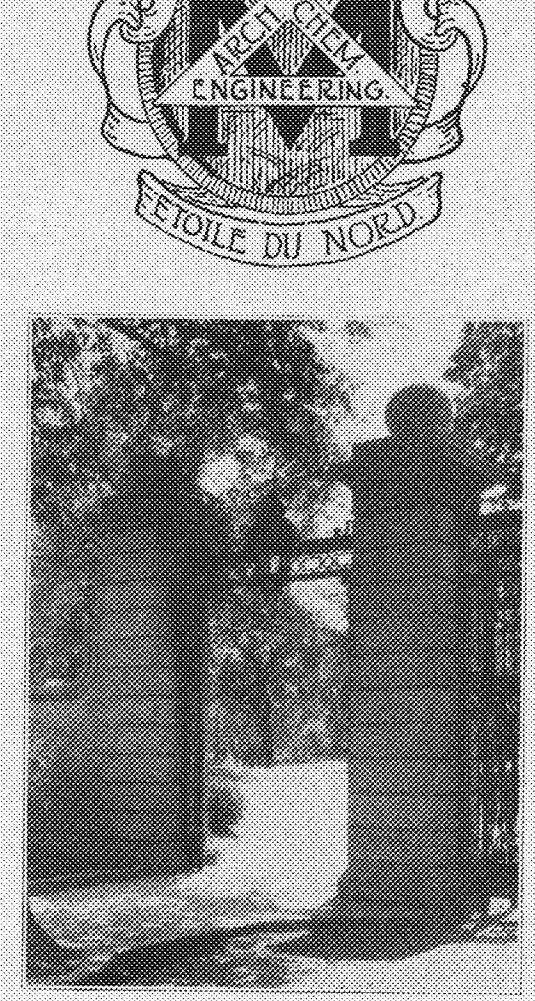
"Not in books, but in things themselves, look for knowledge," he shouted. This man helped to revolutionize methods of thinking—helped to make electricity what it has become. His fellow men were little concerned with him and his experiments. "Will Queen Elizabeth marry—and whom?" they were asking.

Elizabeth's flirtations mean little to us. Gilbert's method means much. It is the method that has made modern electricity what it has become, the method which enabled the Research Laboratories of the General Electric Company to discover new electrical principles now applied in transmitting power for hundreds of miles, in lighting homes electrically, in aiding physicians with the X-rays, in freeing civilization from drudgery.

General Electric

General Office Company *Schenectady, N.Y.*

MINNESOTA TECHNO-LOG



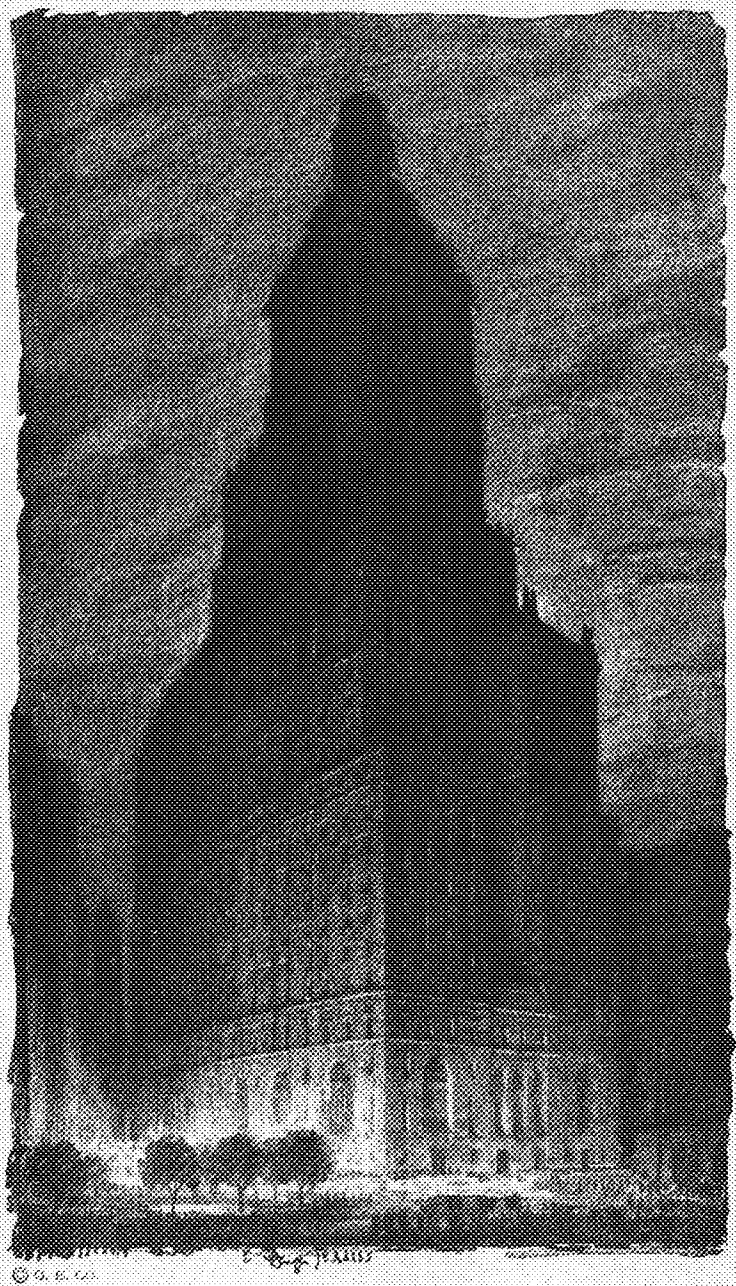
"THE OLD GATE"

DECEMBER 1922

PUBLISHED MONTHLY DURING THE SCHOOL YEAR BY THE STUDENTS OF THE COLLEGE OF ENGINEERING AND ARCHITECTURE AND THE SCHOOL OF CHEMISTRY.

VOL. III UNIVERSITY OF MINNESOTA NO. 2

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED



The Complete Project for the Standard Oil Building New York City

CARRÈRE & HASTINGS
Architects

"The New Architecture"

A DISTINCTLY new tendency is apparent in architectural thought and design today. Architects are designing in masses — the great silhouette, the profile of the building has become of far greater importance than its detail.

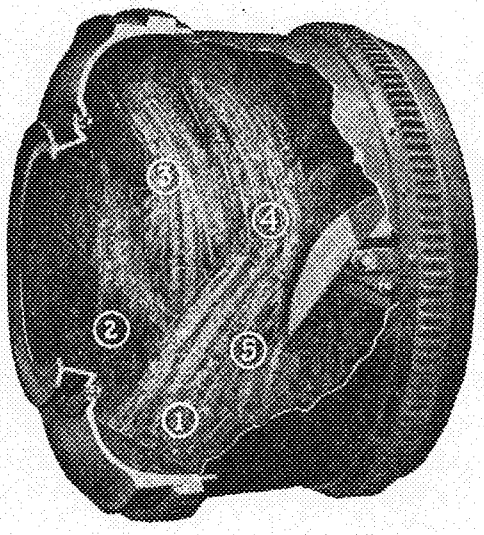
There is a new vigor and ruggedness even in buildings which are conventionally classic in their detail. Masses mount upward, supporting the tower, accentuating its height. The new architecture is tending toward great structures rather than multiplicity of detail.

Certainly modern invention — modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

OTIS ELEVATOR COMPANY

Offices in all Principal Cities of the World

Why does Koehring Five Action Mixing Principle give Plastic Concrete?



(1) Blade cuts through materials with churning action. (2) Blade carries materials up, spilling down again against motion of drum. (3) Materials buried across diameter of drum. (4) Materials elevated to drum top and cascaded down to reversed discharge chute which (5) with scattering, spraying action, showers materials back to charging side for repeated trips through mixing process.

TESTS made at Purdue University by Professor W. K. Hatt prove that plasticity of concrete depends on the proper mixing. To obtain this plasticity in the minimum time, the individual particles of cement, sand and stone must be so mixed that they will find their proper position in the concrete. Then the cement acts as a lubricant and the concrete will be plastic and easy to work, instead of harsh and difficult to place.

The Koehring Five-action Re-mixing Principle prevents separation of aggregate according to size—coats every particle of aggregate thoroughly with cement—and delivers plastic uniform concrete to the last shovelful of every batch.

KOEHRING COMPANY
MILWAUKEE WISCONSIN

KOEHRING
HEAVY DUTY

KOEHRING

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MINNESOTA TECHNO-LOG

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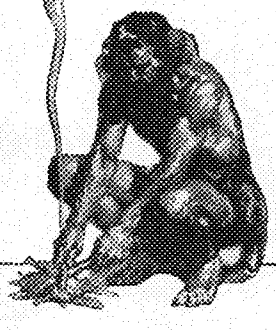
Tapered
ROLLER BEARINGS



Friction

Friction, from the beginning of time, has controlled man's progress, either as a friend or as an enemy.

Earliest evidence of the friendly use of friction was the rubbing of the hands and body to keep warm and finally the rubbing of a pointed stick to start a fire. But friction, like the fire which it starts, is, in many ways, man's formidable enemy.

In the operation of machinery and in the development of all automotive vehicles, friction must be held absolutely under man's control; or else, the mechanical power which has carried man from savagery to his present high estate, would be so wasted as to hold progress and development at a standstill.

Without anti-friction bearings (as they are called) machinery in general would have remained as in great-grandfather's day. No railroads would streak across the land—no motor cars—no trucks—not even power-driven boats could ply.

In this battle, against "enemy" friction, human inventive genius has progressed rapidly from the early cumbersome types of soft, slippery metal collars which encircled axles and shafts—through various applications of balls and rollers—to the tapered roller bearing of today, as typified in the product of the Timken Roller Bearing Company;—

It has progressed from those early nuisances that required greasing or oiling every few hours to the Timken Tapered Roller Bearing of today that requires attention as infrequently as every year or two.

Here we have a light, compact and self-contained device that is friction's absolute master. For not only do Timken Tapered Roller Bearings hold friction to a negligible minimum—

But in so enabling wheels and shafts to revolve at frightful speeds with ease and safety—

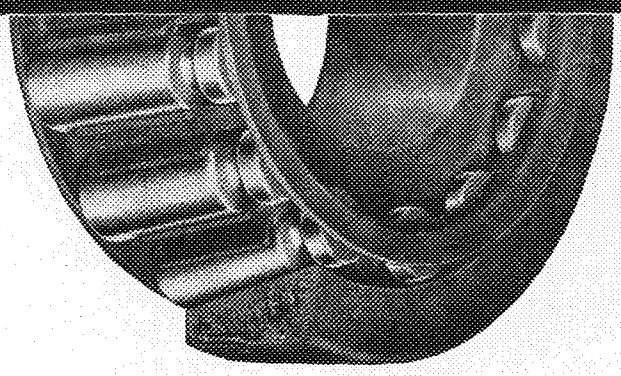
Timken Tapered Roller Bearings, at the same time, carry all the loads that may be thrust upon them regardless of the direction from which these loads may come. No matter how, nor where, nor when that shock or load is applied—

Your Timken Tapered Roller Bearings rest snugly in their various housings, absorbing or deflecting those blows—

The while your motive power is being delivered through these bearings, without interruption, to the driving wheels—

And finally, when that wear which *must* follow all motion becomes apparent,—a simple adjustment and your Timkens function as when new.

The Timken Roller Bearing Co
CANTON, OHIO



MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME III | DECEMBER, 1922 | NUMBER 2

THE NEW UNIVERSITY LIBRARY

Minnesota's Newest Building To Be Five Stories High, Embodies Latest Library Designs

By Paul E. Nystrom

The author wishes to thank Prof. J. H. Forsythe, consulting architect of the Board of Regents, for his assistance in the preparation of this article.

FOR some time departmental expansion has marked the progress of the University. This is evident in the case of the new School of Music, and also in the case of the School of Mines. Of late, the interests of the University as a whole have predominated, and while we are awaiting the erection of the auditorium and stadium, the skeleton of the new library building has come into existence.

A congested library will soon be unknown to Minnesota students. It has long been desirable to provide better library facilities so that a greater number of under-graduate students as well as advanced research scholars might be accommodated. In short, a library building for the library, free from administrative and executive offices having no direct hand in its supervision, has been the ultimate aim of those who have been working out the intricate problem of providing for the present and also for the anticipated future requirements of a Greater Minnesota.

Before long we will view the consummation of endless recommendations, months of study and planning, in the form of a building which will give Minnesota students a library unprecedented in capacity and equipment, and distinctive in its appointments.

Other Libraries Studied

In order to insure these results, a thorough study was made of the most modern institutions in the country. Mr. J. T. Gerould, former librarian, and Mr. J. H. Forsythe, Consulting Architect of the Board of Regents, visited the libraries at Harvard, Columbia, Cornell, Chicago, Leland Stanford, and the University of California, and also the New York Public Library and the Congressional Library. The final plans for the new library represent the acme of architectural ingenuity in that they embody the most practical and modern refinements in design and equipment which are characteristic of the above buildings, and will guarantee to the student body the latest and most approved practice in library design.

Preparation of the Site

The building, which is now being erected, covers a ground area of 205 feet by 182 feet just to the north of the present Chemistry building. It will contains a basement and five floors with a total cubage of 3,000,000 cubic feet.

Before construction could commence, the Northern Pacific R. R. shifted their tracks six feet to the north and covered them in order that the north portion of the building might not be delayed in construction.

The huge earth pile east of the site represents about 20,000 cubic yards of earth which was excavated for the foundations. It is peculiarly interesting to observe that a great part of this is going into the actual construction in the form of aggregate for the concrete.

Structure to Be Five Stories High

The features of the basement floor will be the library school and the map rooms. The remaining space will be occupied by locker rooms, toilet rooms, and equipment rooms.

The administrative offices of the library will be located on the first floor. Considerable space will be devoted to the catalogue rooms, reserve book reading room and delivery desk. A Treasure Room for the exhibition of valuable articles will be one of the points of interest on this floor. Very appropriate, indeed, is the standard library, which is to be equipped similar to a private library containing a representative collection of such books as one might find under those conditions.

Characteristic of a library, the reading rooms are on the second floor. These are two stories in height. The largest reading room is across the front of the building and is designed to seat 350 students. The periodical room will have a capacity of 250 persons. A smaller general reading room will accommodate 250 people. These elements are grouped around a central delivery space at the head of the main stairway.

Seminar rooms occupy the major part of the fourth floor. They are of various sizes, it being the intention to accommodate seminar libraries of a great many kinds. Certain of these rooms are to be equipped with lanterns for lecture purposes.

On the fifth floor, which has but half the area of the lower floors, are the private study rooms, and a book bindery spaced around a central court.

It is estimated that about 1,800 students can be seated in the various rooms at one time. This is approximately six times the capacity of the present library, and is greater than that of any educational institution in the country.

Highest Stack Room in the Country

On the west side of the building, running the full height of the structure, is the stack room. It will comprise twelve stories of stacks, and will have the distinction of being the highest stack room in the country. On the west side of each stack story are a series of cubicles or carols for research scholars.

(Continued on page 32)


All ov de
Oolees

Aha! Aha! What Have We Here---

Another Beauty Contest? No, Gentle Reader, This is Not as Sweeping as That

By GLANVILLE W. SMITH

WE nominate for Minnesota's Hall of Fame—but no, this is not the Ski-U-Mah. At any rate, here we see four celebrities worthy of four large pedestals in the Engineering Hall of Fame.

In the upper left-hand corner Our Artist has depicted the Janus of the Experimental Building. He has very scornful ideas on the subject of research; and it is his especial province to supply for Doc Holman that brand of gritty chalk of which Doc is so notedly fond. As for noise, grease, water on the floor, and the brimstone remarks of the "calculating" engineers, etc., he is quite impervious to it all, quite after the manner of the famous mule which walked into a tree, not because he was blind, but because he "jinst nacherly didn't give a damn."

Next (progressing toward the right) we have the south elevation of one of our immortals going north. Or is it versa vice? Perhaps the artist could tell us, but we have our doubts.

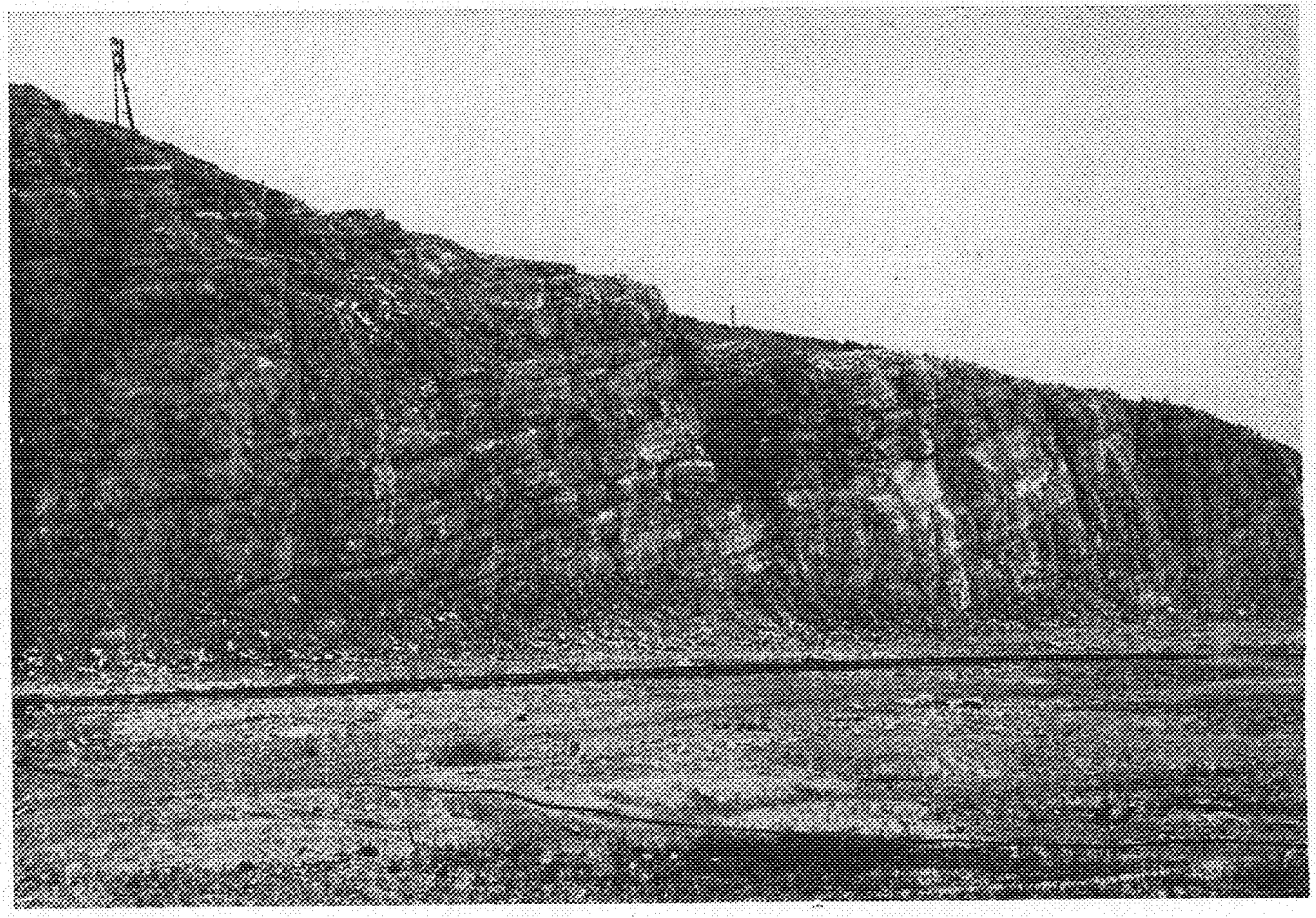
Next, in the upper right hand corner, comes Mr. Johnson, that mysterious character who, as the shades of eve are falling fast, retires into his closet, soon after appearing therefrom attired in all the items of the conventional Sunday Best. This strange phenomenon, reminiscent of the butterfly's emergence from the chrysalis after its existence as a grub, has often been observed by the Dean, the Architects, and the occasional others who work nights as well as days.

In the center of the ensemble we have Ole—or, rather, the upper half of him—Ole, the combined patron saint and Guardian Angel of the Architectural Department. "Giving Ole a cigar" is equivalent to receiving a Mention on the next design problem, it is averred. The other day we found him in the hall engaged in a mock duel with Snowball, the unsnowy delivery boy. It gave us a shiver, for we almost imagined that we were at the Orpheum.

In the lower right-hand corner we have Mr. Hanson, another college celebrity. He says that he feels himself quite a member of the faculty, now that the professors have to run at the sound of a buzzer, a custom formerly confined to the janitorial staff.

And here, rampant, with broom passant, is one of our disciples of Janus in a familiar pose. It looks like Ole, but that is because of the hat.

In the corner is an invisible signature, which you may not have noticed. It reads "E. L. Johnson." He is the man that made the Pretty Pictures, not one of the Janitors.



A WALL OF LIMESTONE

This quarry face of stratified limestone is over eighty feet high. Fifty-one holes, each about 6 inches in diameter, were loaded with dynamite. The volume of the section blasted was over a million cubic feet. With cordeau detonating fuse in every hole, only one electric blasting cap was necessary.

BLASTING AT BETHLEHEM

Limestone Cliff Dynamited to Obtain Flux for Steel Process

This article used by special permission of Mr. Harry Roberts, Jr., editor of the "Hercules Mixer."

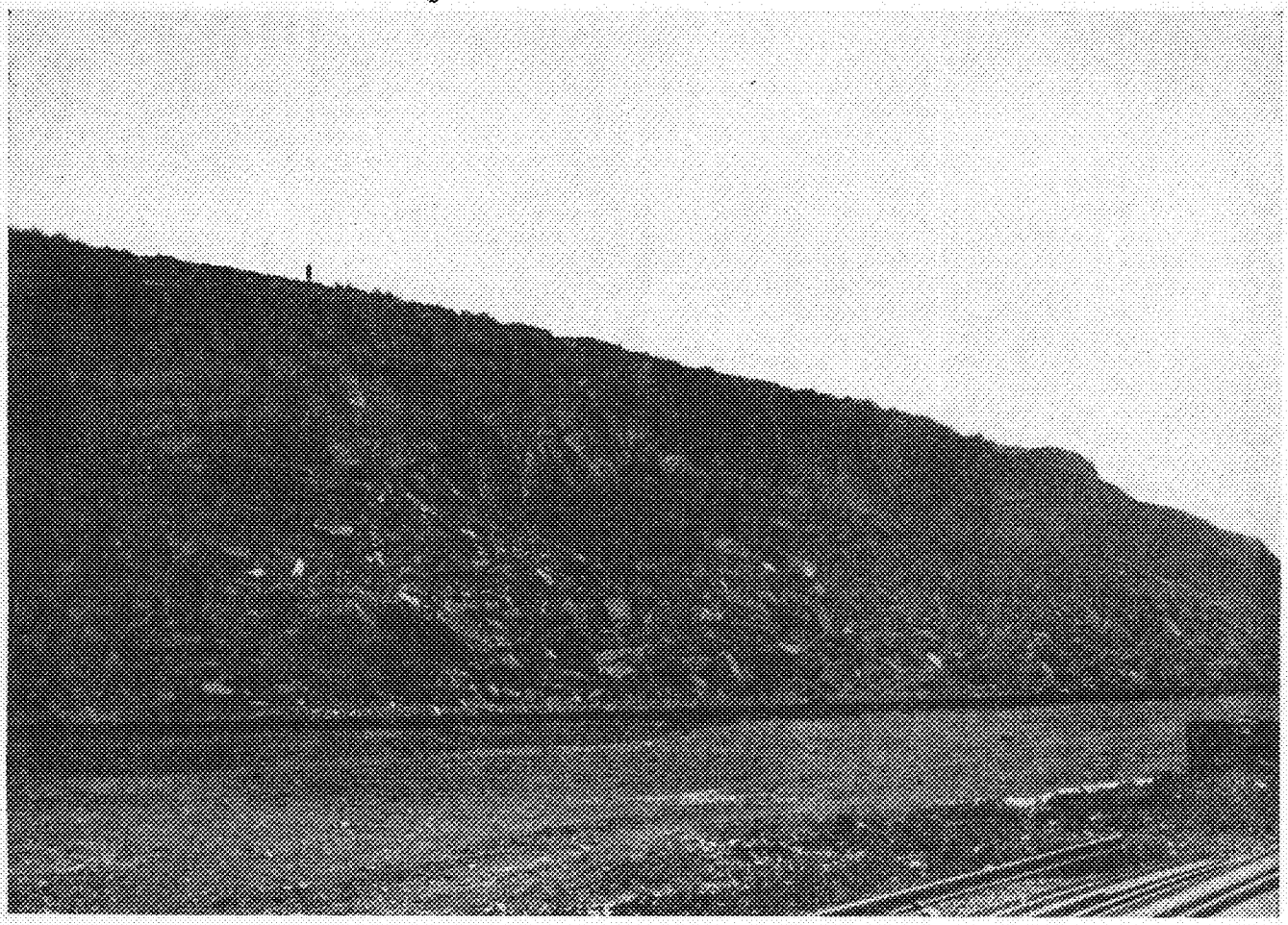
WHEN you think of Bethlehem you think of steel, ships, and Schwab. But before the Bethlehem Company can produce the steel used all over the world in myriad ways it is necessary to obtain the limestone employed as a flux in smelting the iron ore. This limestone, which is blasted by explosives from quarries, is as essential to the ships that have made Mr. Schwab's one of the best-known names in the country as the iron ore itself.

In Bethlehem, Pa., a city settled by a group of Moravians who, seeking religious freedom, came there about two hundred years ago, there is a great steel plant. The Bethlehem Steel Co. was organized in 1857 as the Saucona Iron Co. It was later called the Bethlehem Rolling Mills & Iron Co. The first blast-furnace was blown in on January 4, 1863, and the first rails of puddled iron were rolled on September 26, 1863. The plant first produced pig iron, cast iron, and wrought iron, and billets, rails, and other Bessemer steel products. Following the building of a gun factory and armor-plate plant in 1886, the company engaged largely in the manufacture of armor-plate, and began building the world's largest and most complete open-hearth rail plant, as well as the only American factory for the wide-flanged integral-rolled beams and columns. Today, with its subsidiary companies, owning iron mines, coal mines, quarries, railroads, and steamships, the Bethlehem Steel Co. controls the manufacture of its products from start to finish.

One of the raw materials required for making steel is limestone. It is used as a flux both in the blast and the open-hearth furnaces, and unites with the non-ferrous components of the ore to form a slag, which readily separates from the molten iron or steel. In a normal year the various Bethlehem plants use about two million tons of limestone.

Across the Lehigh river, which runs past the plant, there is a limestone quarry from which stone is obtained for the furnaces. It was here that dynamite was called upon for a large shot, consisting of 51 well-drilled holes averaging over eighty feet in depth.

Firing a large quarry blast isn't as simple as it sounds, or even as it looks in photographs. The holes must be carefully measured; the dimensions of the face and the volume of rock to be blasted must be carefully calculated from actual measurements; the quantity of explosive to be used per ton of rock must be decided upon; the charge required for each hole must be estimated; and the best distribution of the

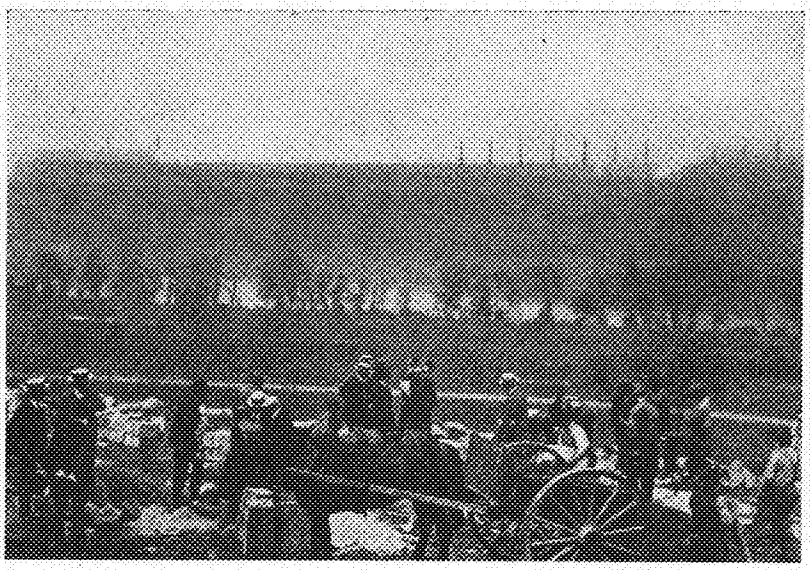


AFTER THE SHOT

Like an impatient child pushing over his blocks, dynamite laid more than 80,000 tons of limestone on the quarry floor in the twinkling of an eye. For every pound of dynamite used, nearly four tons of limestone were obtained. The stone was broken in convenient sizes for loading into cars.

has been accomplished, the work must be done precisely as planned.

A dolly, which is a piece of wood about four feet long, attached to a rope, was used, first, for determining the condition of the holes and checking their depth before loading and, second, for tamping the charges and stemming material. Until the dynamite charge came above the water level, the cartridges were dropped into the hole without slitting them. After the water level was passed, the cartridges were slit and their contents poured in through large funnels which were placed in the iron pipes used for casing the collars of the holes. In some cases, where the holes were too far below grade



LOADING THE HOLES

In the background, across the river, is the enormous Bethlehem Steel Plant. On this particular shot, the Bethlehem Company used 82,000 pounds of

with screenings to give an average depth of the holes of about eight feet below the quarry floor. The rope by which the dolly was lowered into the holes was marked at 25, 50, 75, and 100 feet, so that the progress of loading could be judged at any time. Then the dolly was let down to determine whether the cordeau had reached the bottom. The cordeau was then cut off about six feet above the top of the hole and securely fastened. Deck loading was employed wherever necessary; that is to say, the explosive charges in the holes were separated by layers of stemming where it was thought advisable. The distance of the holes from the face, the relative hardness of the formations at different points, the spacing of the

ENGINEERS' BOOKSTORE REPORT

Annual Statement Explained to Students by Board of Directors and Manager

It has been the plan of the Directors of the Engineers' Bookstore to publish in the Minnesota Techno-log their annual financial statement.

The books are open to the Senate Committee on Finance for audit and have twice been examined under the direction of Mr. E. A. Heilman.

Balance Sheet, June 1, 1922

RESOURCES

Cash	$3,436.00
Accounts Recorded	814.85
Fixed Assets	870.83
Merchandise Inventory	4,029.20
Total Resources	$9,170.88

LIABILITIES

Current	$ 243.80
Membership	3,910.00
Surplus	772.46
Equipment Reserve	300.00
Association of Engineers Student Trust Fund	700.00
Dividends declared	3,244.62
Total	$9,170.88

Detailed schedules of all grouped accounts are on file in the Bookstore and are not published because they only tend to confuse the above arrangement. The accounts receivable are for government purchases made by the Veterans' Bureau. The fixed assets represent the cash register, adding machine, safe, desks, counters, etc. The merchandise inventory represents the value of our stock at the current wholesale cost.

The liabilities represent how the resources would be disposed of in case the store should be forced to discontinue its business. Suppose for instance that it became necessary to distribute the assets by forced sale—of course the stock on hand would suffer most and would probably be sacrificed at about sixty (60) cents on the dollar, or yield about $2,500.00. The other fixtures could be sold for about $600.00. When the government accounts were collected the cash on hand would be about $7,400.00. This cash would then be distributed to the members and creditors as follows:

The current accounts due to publishers, etc. (as above)	$ 243.80
$5.00 to each of 782 members	3,910.00
16⅔ per cent Dividends to members	3,244.62
	$7,398.42

Thus the Engineers' Bookstore would be wiped out, the Surplus Equipment Reserve and Trust Fund would have been absorbed by the extraordinary losses due to liquidation and all claims satisfied. Of course, this supposition is only made to help interpret the Balance Sheet as a conservative member might do, and to show the members why it is a good policy to create a surplus and reserve.

Our statements are based on the fact that we are an operating concern, that even though we must move off the campus there will be a demand for our merchandise and we can obtain one hundred cents on the dollar as long as we are not forced to sell at any price.

However, another problem confronts the Directors. They must distribute to the members all the profits that are due to the year's operation. The following Income Statement summarizes the operating accounts:

Income Statement
(Condensed)

Net sales	$40,092.52
A. Net cost of sales	29,990.82
Gross profit	$10,101.71
Operating Expense—	
Salaries	$ 3,738.98
Supplies	216.61
Advertising	187.92
Depreciation	251.21
Other Expense	283.73
B. Total operating expense	$ 4,678.45
C. Profits from operation contingencies	$ 5,423.26
Bad debts—loss by theft	367.22
D. Net profit for distribution	$ 5,056.04

Distribution of Profit

Dividends payable Oct. 10, 1922	$3,283.58	65%
Reserve for purchase of Equipment	300.00	6%
Trust Fund for Association of Engineers Students	700.00	14%
Surplus	772.46	15%
Net profit as above	$5,056.04	100%

Comment

Using the net sales as a basis for calculating percentages:

A. Cost of Sales	75.0%
B. Operating Expense	11.7%
C. Contingencies	.9%
D. Profit on Sales	12.4%
	100.0%

One of the significant things shown by the above statement is that on an investment of $4,100.00 (average over whole year), the store made a net profit of $5,056.04, or 123% (one hundred twenty-three per cent).

No Higher Prices

Our prices are no higher than others in the same line of business. Of course, our expenses did not include light, rent, or heat, and should we have had to make such payment, the figures would be different. This is clear, however, that 10 per cent is a fair return on any investment and surely we could obtain suitable quarters for far less than the balance of our profit. Our enterprise, then, is a highly profitable one and certainly is justified in being run on the co-operative plan.

It will be noted that 79 per cent of the profits were returned to the students, 65 per cent directly to the members, and 14 per cent given to the development of our college, 21 per cent being retained in the business so that we can continue to grow and better serve the members.

A NEW FIELD IN CHEMISTRY

Possibilities of Chemical Manufacture, a Recent Course, Are Outlined for the Students

By L. Hartkemeir

CHEMICAL Manufacture—what could sound more of industry? And it is all that the term implies,—a course based on semi-factory production of chemicals essential to many industries. Many students think they know everything about chemistry when they can obtain results in a test tube or beaker. But how will those reactions take place in metal or enameled equipment of a hundred pound or of a ton capacity? That is the object of chemical manufacture,—the study of the quantity production of pure chemicals from impure raw materials using semi-factory equipment.

In such a production many factors enter in which would not occur if the product were made in beakers or test tubes. The course in chemical manufacture, therefore, is primarily intended to be one in which the student investigates the influence affecting larger scale production of chemicals: but at the same time it develops ingenuity and originality in the student when he is left to his own initiative with a problem that he must solve in order to obtain the largest and purest yield of the product. The training obtained in such a course is invaluable to the student when he enters industry as a chemical engineer, an industrial or a research chemist, for it develops self-confidence, initiative, reasoning power, good judgment and resourcefulness.

Offered to Seniors

The course in Chemical Manufacture is offered for students in Chemical Engineering and Industrial Chemistry who have completed their Junior year. In the past three years, however, under the direction of Dr. Mann, it has been made so interesting and developed to such an extent that now every student working in any branch of industrial or technological chemistry finds that his chemical education is not complete without it.

The course is scheduled for the first session of summer school, for it is entirely a laboratory or factory course, requiring eight hours of work per day. It consists of two parts—three weeks in the working out of problems in organic chemical manufacture, and three weeks on organic problems.

The method of procedure is as follows: Two students work together on each problem, and no two problems in the course are alike. The first step in the work is to obtain from the library the various commercial methods in use for manufacturing the product that has been assigned. The next step, after the various processes have been outlined and are clearly in mind, is to try out the processes that appear to be the best on a laboratory scale, in glassware, in order to obtain some of the conditions that will have to be met with in large scale production. Having determined the best process by the laboratory method, this process is then used for manufacturing the material on a semi-factory scale, that is, producing ten to twenty-five pounds of the material, using equipment that would ordinarily be used in a factory production of it. Cost data are kept at all stages so that the entire cost of each product may be obtained.

Training for Research

A student is expected to exhaust the literature in attempting to solve any difficulty he may meet in his problem. This is splendid training for any research work he may later pursue. If unsuccessful, he then brings up his problem before the class, which meets every morning, and here it is discussed from all angles. Thus every student knows the essential parts of all the other problems being worked on.

A few of the many interesting questions met with in working out the problems are: 1. The time and labor required for the production. 2. The cost of drying, of recrystallizing, of evaporating, of fusing, or of calcining. 3. The amount of wash-water used for purifying precipitates and the cost of that water. 4. The correct temperature to be used for fusion, for calcining, or for distillation of large quantities. 5. The best method of agitation of the large mass to prevent overheating. 6. The type of filter press or vacuum evaporation that would be most efficient. These and many more questions of a similar nature, which occur daily in chemical engineering practice, are met with and solved by the students in this course.

A list of a few of the products manufactured this past summer are given to show the scope of the work. In the inorganic field such materials as zinc sulphate from zinc of old dry batteries, potassium permanganate from pyrolusite, ferric alum from ferrous sulphate and ammonium sulphate, lithopone from barytes and zinc sulphate, soft glass, magnesium sulphate from magnesite, Prussian Blue from spent (gas house) oxide, sodium thiosulfate from soda ash and sulphur, magnanese sulphate from old battery mix, lead chromate, and ferrous sulphate from hydrogen sulphate generator residue were made.

Products Manufactured

A few of the organic materials made were alcohol from starch, paper pulp from spruce, oxalic acid and furfural from corn cobs, casein and milk sugar from skim milk, cream of tartar from argols, various colored lakes, the sulphonation of benzol, and distillation of such materials as coal tar, gas drip oil, and corn cobs.

Many of these products are used for making others, and some are turned in to the stock room for student use in the laboratories. At a later time, it is hoped that in an advanced course some of the deteriorated stock chemicals will be purified and recovered, others will be made from waste products, and the more difficultly obtainable chemicals used in large quantities by the University will be made.

An article on this course would not be complete without a list of the main pieces of equipment in our "factory." 1. Three types of filter presses, namely, a Sperry, a Kelley, and a Sweetland. 2. A Sperry single effect vacuum evaporator. 3. A continuous still and condenser. 4. Nutsch suction filters. 5. A large Duriron steam jacketed kettle. 6. Large iron

(Continued on page 39)

ALUMNI NEWS

John E. Magnuson, E. E. '22, is now at 720 W. Third St., Duluth, Minn.

George Fraser, Arch. '18, is an assistant professor at the University of Ohio.

Myron Dassel, Arch. '18, is traveling in Europe, and studying by the way.

Milton Anderson, Arch. '21, is doing contracting work in Sioux City, Iowa.

John M. Reardon, C. E. '22, of St. Paul, is with the Butler Construction Co.

Geo. Stewart, Arch. '22, is with the Sperry Realty & Investment Co., of St. Paul.

Stanley Hahn, Arch. '22, is working with Magney & Tusler, Inc., in Minneapolis.

George H. Ellingson, Arch. '20, is practicing architecture in Duluth, Minnesota.

Adolf Wagner, E. E. '98, is located at 617 N. Capitol Ave., Indianapolis, Indiana.

Harry Knutson, M. E. '17, is Chief Draftsman for the Clyde Iron Works at Duluth.

Lief J. Sverdrup, C. E. '19, of ski-jumping fame, is traveling in Europe for his health.

A. D. Wills, Arch. '21, is working for Long & Thorshov, architects, in Minneapolis.

Stewart Wright, Arch. '19, is also in the office of the State Architect, C. H. Johnston.

R. Roy Simmonds, C. E. '21, is with the Michigan State Highway Dept. at Escanaba, Mich.

J. F. Keeler, C. E. '22, of Pipestone, Minn., is on the Minneapolis city planning commission.

Harry Andrus, C. E. '22, is engaged in reclamation survey work near Spokane, Washington.

H. J. Frost, C. E. '22, of Spring Grove, Minn., is on dam construction work in Winton, Minn.

R. V. Wright, M. E. '98, is in business in East Orange, N. J. His address is 398 North Walnut St.

Lester Newbery, C. E. '22, of Crookston, Minn., is doing state highway work at Farmington, Minn.

T. S. Paulsen, C. E. '22, 1595 Blair St., St. Paul, is with Foley Bros., railroad contractors, in St. Paul.

H. G. Plank, E. E. '22, is manual switchboard engineer for the Western Electric Co., at Berwyn, Ill.

John M. Downie, E. E. '22, has made connections with the General Electric Company at Schenectady, N. Y.

L. J. Dunlap, E. E. '17, is an instructor in Electrical Engineering at Iowa State College, Ames, Iowa.

Louis F. Riegel, E. E. '11, is now Sales Agent for the Savannah Electrical and Power Co., of Savannah, Ga.

Edwin Larson, Arch. '21, and Edward Buenger, Arch. '19, are with Ellerbe & Co., Architects, in St. Paul.

A. E. Rood, E. E. '22, spent the past summer with the engineering division of the Yellowstone Park Hotel Co.

Ogden Beeman, Arch. '22, is in the firm of Tourtellot & Beeman, architects and engineers, at Oelwein, Iowa.

Alex Levens, E. E. '22, is teaching drawing and descriptive geometry in the Engineering College at Minnesota.

Miss Eva L. Beck, for twelve years secretary in the Dean's office, is at home at 3042 Irving Ave. S., Minneapolis.

H. B. Palmer, C. E. '22, of Bemidji, Minnesota, has accepted a position in an Engineering concern in Milwaukee.

Karl A. E. Berg, C. E. '20, is in the employ of the Northern Pacific Railway, at 520 Securities Building, Billings, Mont.

Harry C. Cook, M. E. '10, is with the Red Wing Iron Works. His address is Bush and Levee Sts., Red Wing, Minn.

David M. Giltinan, M. E. '16, is in business in the South, being located at 1223 Virginia Street, Charleston, W. Va.

Paul Rosenthal, E. E. '22, is working with the State Highway Department, as bridge inspector at Sauk Centre, Minn.

C. C. Cowin, General '21, is in the engineering department of the Washington Water Power Co., of Spokane, Wash.

Walter J. Lee, E. E. '20, is now at 196 Regent Street, Youngstown, Ohio, employed by the National Lamp Works.

Henry M. Lende, C. E. '20, since his graduation here, has been with the Great Northern Railway Co., at Lisbon, N. D.

Paul Damberg, Arch. '22, and his brother, Reuben Damberg, Arch. '21, are with an architect named Berg, in Eveleth, Minn.

C. M. Jesperson, E. E. '22, has gone with the Federal Phosphorus Co., and now lives at 112 E. Fifth St., Anniston, Alabama.

John E. Morrison, E. E. '22, of Cusson, Minnesota, is doing structural steel designing for the Spears-Jevne Company.

Among those busy in the construction of the Mississippi River bridge at St. Cloud may be found Paul Rosenthal, C. E. '22.

M. J. Orbeck, C. E. '11, of 528 Elm St., Ann Arbor, Mich., is teaching in the College of Engineering of the University of Michigan.

Charles P. Demarest, E. E. '11, is helping the American Telephone and Telegraph Co., at 195 Broadway, New York City.

Wm. E. Willner, Arch. '22, of Duluth, Minn., is taking graduate work at Pennsylvania on a scholar-

ship. His address is 3904 Baltimore Ave., Philadelphia.

Earl H. Lund, C. E. '22, of Minneapolis, is now in the office of H. A. Hildebrandt, the superintendent of buildings and grounds.

John E. Wallfred, M. E. '20, 4554 Wentworth Ave. S., Minneapolis, is in the employ of the Northwestern Bell Telephone Co.

J. H. Spicer, formerly in the Enginering College, is now an up-to-date farmer. His address is R. R. No. 2, Wiarton, Ontario, Canada.

Robert C. Rome, E. E. '22, is with the traffic department of the Northwestern Bell Telephone Co., with headquarters at Omaha, Neb.

C. L. Motl, C. E. '10, is a division engineer with the Minnesota Highway Dept. His residence is 1232 Marshall Ave., St. Paul, Minn.

Ed. Love, Arch. '20, is with C. H. Johnston, the State Architect, at St. Paul. Mr. Love received his Master degree from Harvard in June.

Charles A. Pardee, E. E. '13, is a member of the firm of Miller & Pardee, of Chicago. His address is 625 W. Jackson Blvd., Chicago, Ill.

H. R. Rosendahl, C. E. '22, and J. H. Bourdenhoff, C. E. '20, are investigating oil properties from their headquarters in Mexico City, Mexico.

A. O. Cunningham, C. E. '94, is Chief Engineer of the Wabash Railway at St. Louis, and lives at 6328 Washington Ave., St. Louis, Mo.

Archie J. Dowd, M. E. '19, is designing for the Western Electric Co. at Oak Park, Ill. His home is at 739 N. Bridgeland Ave., Oak Park.

Miss Faith Nixon, Interior Decorating '22, 417 11th Ave. S. E., has accepted a position designing interiors for Wm. A. French & Co., of Minneapolis.

Catherine Smit, '22, the only girl to graduate from the construction option course, does not expect to use her technical training, and is living at her home in St. Paul.

Dean M. Barnes, E. E. '21, is doing engineering work for the Associated Telephone Co., of Long Beach, California. His residence is 750 Rose Ave., Long Beach.

Robert Steffens, E. E. '22, is now in East Pittsburgh, Pa., in the employ of the Westinghouse Electric and Manufacturing Co., in their student graduate course.

Mr. M. Cornelius, E. E. '06, is with the Westinghouse Electric and Manufacturing Company of East Pittsburgh, Pa. His home address is 1104 Braddock Ave., Swissvale, Pa.

Miss Gladys Brouillard, Arch. '22, is doing post-graduate work here, and also defending the office of the head of the department, Prof. Mann, from desperate architects.

Cardwell M. Hanna, formerly a member of the civil engineering class of '16, is located with the Clyde Iron Works at Duluth, serving in the capacity of Chief Estimator.

Miss Gertrude Quinn, Arch. '21, has been teaching in Hackensack, North Dakota. She attended the Minnesota Educational Association convocation in Minneapolis last month.

Richard H. Hoffman, C. E. '22, has accepted the position of representative for the C. F. Church Mfg. Co., of Holyoke, Mass., with headquarters at 923 Nicollet Ave., Minneapolis.

Miss Alice Little, Arch. '21, who has been in Professor F. M. Mann's downtown office, in the Metropolitan Bank Building, will motor south with her family, to spend the winter in Florida.

D. J. Deneen, Arch. '19, is employed by Holstead & Sullivan, Architects, of Duluth, Minn. At present Deneen is doing work for School District No. 1, Itasca County, at Grand Rapids, Minn.

A. W. Groth, E. E. '20, is in the engineering department of the Western Electric Company at Hawthorne Station, Chicago, where he says there is a large representation of Minnesota men.

Oliver Stoutland, C. E. '22, who has until recently been with the St. Paul Structural Steel Co., is now engaged in relocation and construction work with the C., St. P., M. & O. at Jim Falls, Wis.

Harry Andrus, C. E. '22, passed through Minneapolis on his way east, recently, to join an engineering firm in Boston. He intends to study at Massachusetts Institute of Technology next year.

Jay C. Vincent, E. E. '03, has taken up the work of the late F. W. Cappelen as Minneapolis City Engineer, with offices in the City Hall. Mr. Vincent's home is at 4733 Lyndale Ave. S., Minneapolis.

I. Kvitrud, M. E. '11, as a member of the firm of Kvitrud & Madsen Company, General Contractors, spent the summer superintending the erection of a city grade school at 38th St. and Harriet Ave., Minneapolis.

Lawrence H. Bakken, Arch. '22, who recently was convicted of having committed matrimony, is taking post-graduate work at Minnesota, and is also with Northwestern Lumbermen's Association in Minneapolis.

Norman Kingsley, E. E. '20, has exchanged his former interference tactics for new methods of overcoming interference, as he has charge of that department in the Northwestern Bell Telephone Co., in Minneapolis.

Lester H. Knapp, E. E. '12, and family are living at Keokuk, Iowa, where Mr. Knapp is employed as assistant general superintendent with the Mississippi River Power Co. They spent their vacation driving through Iowa and Illinois and visiting friends and relatives in Chicago and Milwaukee.

Harold S. Langland, E. E. '19, is on the staff of Delos F. Wilcox of New York, who was employed as expert for the City of Minneapolis in the pending Street Railway rate case. Langland is at present in charge of the valuation of electrical equipment, power plant, and rolling stock of the Denver Tramway Co., for the City of Denver. His wife and four-months-old daughter are also in Denver. They can be reached by a letter to 1458 Josephine St., Denver, Colo.

James H. Werdenhoff, C. E. '21, is with the Compania Mejicana de Terrenos y Petroleo, S. A., at Frontera, Tabasco, Mexico. He writes: "I have been doing engineering work in Mexico ever since my graduation in March, 1921, often being so remotely removed from the ordinary paths that only the luckiest of letters get through to me. At present, I am doing field engineering for the company whose interminable name is at the letter-head, and as I am located in a warm and lazy climate I cannot exert myself to write it out. The country roundabout is beautiful, occasionally to the sense of sight; but the pity is that we are guided by five senses and not one or two."

SPORTS

NOW ARGUE ABOUT THESE!
Here's the Techno-Log's Choices for the All-Conference Eleven

First Team	Position	Second Team
Kadesky, Iowa	End	Haney, Indiana
Thompson, Iowa	Tackle	Below, Wisconsin
Pixley, Ohio	Guard	Minnick, Iowa
Heidt, Iowa	Center	Blott, Michigan
Lewis, Chicago	Guard	Slaughter, Michigan
Fletcher, Chicago	Tackle	Penfield, Northwestern
Goebel, Michigan	End	Ecklund, Minnesota
Uteritz, Michigan	Quarterback	Barr, Wisconsin
Marineau, Minnesota	Halfback	Workman, Ohio
Kipke, Michigan	Halfback	Williams, Wisconsin
Locke, Iowa	Fullback	Cappon, Michigan

INTRAMURAL SPORTS

Football was not a success this year because of the late start and because the Engineers and Miners were the only ones who had teams. It is interesting to note, however, that in the Engineering College alone there were over two hundred men who wanted to try out for the college team and the class teams. Next year, football will be organized during the first week of school and practice will start at that time, so there will be plenty of time for the playing of an Inter-College schedule.

Basketball is just starting and the Engineers are out to uphold the precedent set by teams in former years, by winning the college championship. Each of the four classes will be represented by a team and these teams will play for the class championship of the Engineering College. The college team will be chosen from these men, and this team will represent the college in the Inter-College tournament. Indications are that Engineers will get together a classy bunch of basket cagers for this tournament. There will undoubtedly be a trophy cup to be presented to the college winning the championship, the members of the winning team receiving Intramural "Ms."

Bowling is also due to start soon and will be carried out along the same plan as basketball. Arrangements are being made so that the bowling matches can be played off on alleys within a couple blocks of the campus. Prospects look good for a successful Engineers' team, as a large number of experienced men have signified their intentions of coming out. The men having the highest averages during the class matches will make up the team representing the Engineering College in the Inter-College matches.

VARSITY BASKETBALL

With the football season complete our attention turns to the coming basketball season. Doc Cooke has been holding practices three times a week for the last month and has been spending most of the time in teaching his men the fine points of passing, dribbling, basket shooting and the like. The regular practice sessions will start in earnest now that the basketball men on the football squad are free and the team will soon begin to take definite form. There will be a goodly number of experienced varsity men from last year's team eligible this year and also several members of last year's Freshman team who are sure to make regular berths on the squad. Old men who will be out to defend their jobs against all comers are Captain Rudy Hulteranz, veteran guard, and greatly feared by all conference teams; Severinson, veteran forward, who is one of the slipperiest men in the conference and also has an accurate shooting eye; Schjoll, who made his letter two years ago and is a strong candidate for the pivot job; Bergsland, guard, who showed up in great shape last year; Sinclair, guard, who is a big capable man; and Cy Olson, forward, who played in several games last year. Among the most outstanding of the new men are: Ray Ecklund, of last year's Freshman team, one of the cleverest men on the basketball floor who has been seen here in years, and is almost sure of a regular place on the team at almost any position; and Ted Cox, also of last year's Freshman team, who is considered almost a sure bet at either guard or pivot job. There is some doubt as to whether the injuries he received during the football season will prevent him from playing basketball or not; but the chances are that he will be perfectly fit. There has also been a rumor that Marty is coming out, and if he shows up on the floor anywhere near like he does on a football field, Gopher stock will take a big jump. There are several other good men, any one of whom is liable to pull the dark horse stunt.

The Engineers are well represented on the basketball squad as usual and are sure to have several men among the letter men at the end of the season. They are Severinson, Junior Civil; Bergsland, Senior Mechanical; Roy Williams, Senior Electrical; Cy Pesek, Sophomore Civil; Walter Maiser, Senior Civil, and Verne Babcock, Senior Electrical.

The three practice games allowed the team under conference rules will be played with Hamline, Macalester and St. Olaf, according to Doc Cooke. Hamline will be played December 9; Macalester, December 15, and St. Olaf, December 19. All of these games will be played on the Armory floor.

HOCKEY

With the coming of cold weather the hockey enthusiasts are getting ready for a busy season. This should prove to be a banner year if present plans materialize. Bill Taylor, manager of the hockey team, has been busy preparing a schedule and arranging for the practices which will be held on the armory floor until the weather will permit the use of outdoor ice rinks. The schedule will include matches with Wisconsin, Michigan, Michigan Aggies, and the University of Manitoba at Winnipeg. The plan is to play two games away and two at home with each of these teams. The indoor practice is a new departure in hockey training and will

be in charge of Director Luehring and Coach Metcalf. This indoor work should put the candidates for the team in fine physical trim by the time actual ice work starts. The coaches will have plenty to do, as there is a squad of between fifty and sixty men out for the varsity team and as many more will be out for the freshman team. Minnesota will be represented by a first-class hockey team, as there are several of the regulars from last year in addition to several men who were ineligible last year but who now have clear records. The freshman team is expected to give the regulars many hard scrimmages. They will have men who have had considerable experience and will force the varsity to play their best to beat them. A regular schedule of games with state college teams is being prepared for the freshman team and will make keen competition for the different positions.

FOOTBALL

With the 1922 football season completed successfully, more successfully than anyone dared hope at the beginning of the season, it gives us a rather pleasant sensation when we think of prospects for next year's team. The only men who will be lost to the squad next year are Mitchell, Gallagher, Hultcranz, Copeland, McCreery, Schjoll, and Captain Aas. There is some doubt as to whether Captain Aas will return next year or not; but indications are that he will return, as he will still be eligible for another year of conference competition. This will leave the line wholly intact from tackle to tackle and although Schjoll's place at end will be a hard one to fill, should give the Gophers a fine second to none in the Big Ten next year. This year's experience, in addition to the pep and fight they have shown all season, in spite of their lack of experience and the fact that they were up against the strongest lines in the conference, should make them almost unbeatable.

Cole, McDonald and Gross at tackle and Abrahamson, Gay, Larson and Rollitt at guard, and Captain Aas at center have been a big factor in stopping ambitious line plungers and can be counted on to spoil the reputation of many a perfectly good smashing back next year. Schjoll and Ecklund at the wing positions showed up strongly in stopping wide end runs and Ecklund's toe has been a factor in all the games. Ecklund and his toe will be back next year and with several good candidates for the vacant place at the other end, the wing jobs should give no trouble.

In the backfield, the story is not so pleasant, as McCreery, the driving, plunging halfback, will not return. This makes a big hole in the backfield, as McCreery was the most consistent ground-gainer on the team and excelled in off-tackle drives that rarely failed to gain the necessary yardage. Marty will be back again next year to do big things along with Grose, Pederson and Oster. With a man to fill the vacant halfback job, this backfield is due to cause some folks a whole lot of worry next year. Mitchell, who alternated at full with Pederson and Oster, will be lost by graduation, and his loss will be keenly felt, as the past season has shown that three fullbacks were none too many, as one or the other of the three were laid up with injuries or sickness all season. Barring accidents, there will be no other vacancies or changes in the lineup, unless some of this year's freshman team beat the veterans out of their jobs and there were some exceptionally

Coach Bill Spaulding and his corps of assistants deserve a great deal of praise for the splendid progress they have made in their first year here. These men have whipped together a team which has drawn capacity crowds in all its games, at home and away, and these crowds have seen the Gophers fight without quitting, under overwhelming odds.

Coach Thorpe of the swimming team, now under full time contract at Minnesota, is having no difficulty in getting out all the available material in the University. Thorpe can be found in the pool at the armory any afternoon, and, while official practice does not begin until November 1, Thorpe wants every man to report to him at the earliest date possible. Thorpe has lost but four men from last year's championship team, and has a wealth of material to offset this loss.

Atwood and Jordon, Minnesota's star plunging duo, will be the hardest to replace, but Thorpe hopes to develop a pair of otters out of some of the heavyweights to be seen on the campus. Horace Nutting, sophomore engineer, is making a strong bid for one of the places left vacant by last year's plungers. Bird, sophomore diver, will undoubtedly be Thorpe's star in that event, though Brunner of last year's team will make him work to stay in the limelight. Hugo Hanft, another sophomore engineer, appears to be the brightest luminary on the dash horizon. Between Gow and Hanft, Minnesota ought to carry off the greater part of all dash events. Craig, Ludvigson, and Jenkins, all engineers, are making their first bid for fame via the water route. Captain Murray Laupher, twice conference champion in the 440, appears to be in the best condition of his career, and hopes to pilot his team to another championship.

W. J. Diederichs, associate professor of mechanical engineering and who is in charge of the industrial engineering courses at Iowa State College, was chairman of the industrial conference recently held at the Westinghouse Electric and Manufacturing Company at Pittsburgh, Pa. Seventeen engineering teachers from various schools throughout the country were present at the conference.

"I was much interested in their pay system," said Professor Diederichs. "It is known as 'standard time' and has its basis on a thorough job analysis. A committee assigns each job to one of five classes, A, B, C, D, or E; class A being the highest and class E the lowest. Experience and skill required, disagreeableness of work, responsibility connected with work (cost involved) and general education required, were considered in classifying a job to a class.

"Each class is assigned a range of wage which is set with some regard to competition, living costs and general wage for like work in the district. A man cannot receive more money if he is already getting the top wage for the class job he is doing, but when he has reached the top of his class he is encouraged to try a job in the next higher class. It is possible for him to work from class to class and improve himself. This seems to be a sane, just method to give a man the incentive to improve his condition."

I don't want to be a knocker;
It never buys you peace.
But the wheel that squeaks the loudest
Is the one that gets the grease.

"THE THEORY OF NUMBERS"

By Prof. J. H. Rowen

In the edition dated October 13, 1922, "Science" published an article under the title "The Theory of Numbers," by Prof. G. H. Hardy; being a selection from the address of the president of the Section of Mathematics and Physics, given at the Hull meeting of the British Association for the Advancement of Science. In this article, several questions were raised to illustrate the insufficiency of our system of integers and their representations.

This insufficiency has been keenly felt by the writer, and he was, therefore, interested in the questions put forth at the Hull meeting. He takes this opportunity to comment on one of them; namely, "When is a number the sum of two cubes, and what is the number of its representations?"

To the above, there is no strictly simple answer, but there is a test; which test, however, may involve much work for large numbers. The test is here stated:

Let "n" equal the number under consideration. The question is, can "n" be expressed as equal to $x^3 + y^3$ when x and y are integers?

The test is, to determine whether or not "n" has an integral factor ("b" for instance) which is greater than $\sqrt[3]{n}$ and is less than $\sqrt[3]{4n}$ that will meet the following conditions:

$$1/3\left\{\frac{4n - b^3}{b}\right\}$$ must be a perfect square. (Formula (1).)

A preliminary test may be stated as follows:

$(4n - b^3)$ must be divisible by 3. (Formula (2).)

By applying this test, much work may be saved, but it is not a final test. It must be met, however. If it is not met, "n" cannot be written as equal to $x^3 + y^3$. If it is met, proceed to the final and only real test, namely:

$$1/3\left\{\frac{4n - b^3}{b}\right\}$$ must equal a perfect square.

The number of its representations ("n"s) is determined by the number of factors b_1, b_2, b_3, etc., between $\sqrt[3]{n}$ and $\sqrt[3]{4n}$ that meet the above conditions.

Example: Let "n" equal 1729.

$\sqrt[3]{n} = 12 +$ and $\sqrt[3]{4n} = 19 +$.

The values of "b" must lie between 12 and 19, then.

Factors of 1729 between these limits are 1, 13, 7, 19. The only allowable factors are 13 and 19.

$$1/3\left\{\frac{4\times1729 - 13^3}{13}\right\} = 121,$$ a perfect square.

$$1/3\left\{\frac{4\times1729 - 19^3}{19}\right\} = 1,$$ a perfect square.

By proper substitution of x and y in Formula (1), it is found that $x - y = 11$; and $(x + y)$, a factor of 1729, equals 13. Solving simultaneously the above equations, $x = 12$ and $y = 1$. By the same process, letting "b" equal 19, the following values of x and y are determined: $x = 10$ and $y = 9$. Hence, there are two pair of values of x and y that will satisfy $x^3 + y^3 = 1729$.

ELECTRICITY IN ITS INFANCY

We are only on the threshold of the Electrical Age. People who see the progress made in electrical applications; who now see trolley cars going where once the horse-drawn vehicle went; who are accustomed to having their houses lighted at the turn of a button; who have electric lights to make their streets as bright at night as in the day; who find their factories run by electricity; and who see the thousand and one ways in which electricity is saving time and labor—these people may think we are in a completely electrified world.

Nothing could be farther from the truth. As a matter of fact, the work of the electrical industry has just begun. Business is good, and is going to continue to be good for the next year. One of the reasons for this good business outlook is the vast amount of building, both of office buildings and homes. All this activity helps industry. The effects of this building increase are being felt in all kinds of industries, and particularly the electrical industry, for it will have its wiring and the installation of appliances, illumination, convenience outlets, etc., to do.

These new building projects are practically all to be electrified, and perhaps this may seem to the laymen that we are living in a completely electrified world. But it is a fact that of all the homes in the country, only about 30 per cent are wired for electricity, and of the number which are wired only about 20 per cent are adequately wired. Right here is some business for the electrical fraternity.

This wiring proposition is not all of it, however. One of the biggest problems of the electrical industry is to supply homes with enough convenience outlets to take care of the increasing number of electrical appliances now being placed on the market.

Those who think that the world is completely electrified should know that the farmers throughout the country are now awakening to the advantages of electricity and that thousands of light and power units are now being installed where it is inconvenient for the central station to run power lines. The farmer is finding that electricity is a great saver of time and labor.

Of all the railroad mileage in the country, there is only about 2 per cent electrified. This statement sounds as though there might be something the matter with railroad electrification. But the fact that there is not a large railroad in the country that is not now investigating the application of electricity to its lines only further bears out my first statement that electrical development is only in its infancy.

The same thing is true of the inland waterways and ocean steamship companies. Nearly all of them, today, are working on the application of electrical propulsion to their own particular problems.

It is true, also, of the industries. The steel, coal, mining, in fact, all the fundamental industries of the country, are working on their own electrification problems.

The world today is not electrified. It is just becoming electrified. Within the next few years there will be a thousandfold increase in electrification, which means, of course, that the life of every citizen in the United States is going to be affected, indirectly perhaps, but directly for the most part. Electricity and the electrical industry is just in its infancy.

EDITORIALS

WHY SO MANY?

Organization is the keystone of modern progress, yet it is one of the common complaints of the modern American that he is "organized to death." With our committees, conventions, honorary boards, societies for the prevention of this or that, and associations of whatnot, what is a poor man to do? There are usually two solutions to the problem. We have on the one hand the inveterate "belonger," the professional "joiner"; on the other, there is the type that goes his narrow way caring nothing for society and scorning all organization. It is, indeed, a queer fact that nearly all Americans of our generation fall into one of these classes.

University students usually pride themselves on being a little more advanced in their ideas than the ordinary layman, and it would seem that here at Minnesota we have indeed carried this superorganization idea to its extreme.

In our College of Engineering we have one group of eight organizations with very closely interrelated functions. The Student Council, the A. E. S., the A. A. E., the A. S. M. E., the A. S. C. E., the A. I. E. E., the Chemical Club, and the Architectural Society are organizations whose aims range all the way from pure governmental to part governmental, part social to purely social. Why not eliminate this bewildering array and substitute one organization with purely governmental powers, and one other organization with social objectives, the purpose of which would be to promote good fellowship and friendship among the students in the Engineering College? This latter organization would have meetings regularly, probably once every two weeks, for which prominent speakers would be secured. Thus, this one organization would serve the purpose of relating the student to his future work through contact with practical engineers in civil life and would bind the college together through the frequent social contact of the students. Affiliations with the national bodies, of which we now have so many student branches, could be secured through this one organization as well as through five or six.

Furthermore, the Engineering College is surfeited with honorary societies. There is Tau Beta Pi, Pi Tau Sigma, Eta Kappa Nu, Tau Sigma Delta, Phi Lambda Upsilon, all purely scholarship honoraries, and Sigma Xi, a scientific honorary. Why would not one society serve far better in replacement of the first group of five? Their objectives are the same.

We can be grateful that there is only one dramatic society on the engineering campus, which fills a decided function of its own and deserves support.

In addition to these societies we are loaded down with those of an All-University character such as honorary Junior and Senior societies, honorary military, class clubs, as the '23 and '24 clubs, freshman and sophomore commissions, and many more.

The result in the University as in business life is that we have two classes, the "belongers" and the unbelievers. Both conditions are to be avoided as harmful to the best type of student development. And the remedy is so obvious. Slash this program of a multiplicity of dead useless organizations down to a minimum and then concentrate our energy and will into making these really worth while.

We need one governmental organization, one social association, one honorary society, one school paper, one dramatic society, but no duplications of these functions. Better to have one live organization than ten dead ones.

THAT 1924 GOPHER

In outlining the policy of the 1924 Gopher, Barnard Jones, the annual's Managing Editor, stressed in particular the part that will be played by engineers in the compiling of the contents of the book.

"The Engineering College representative, Walter Wilson, has crashed through with some mighty fine ideas," Mr. Jones told the Techno-Log interviewer. "With such co-operation the College will have a section of which every engineer can be proud. We plan, of course, to give every college equal representation in the Gopher, but the Engineering College and allied schools, holding, as they do, one of the foremost positions on the campus, cannot fail to occupy an especially prominent position in a book like the Gopher, which seeks to mirror life and activities at Minnesota."

A number of engineers are occupying berths on the Gopher ship of state, among them being, besides Walter Wilson, Charles Milkes and Charles Rheinstrom. Several of the Miners and Chemists are also on the staff or the board of publishers.

"It is not a question of how many members of any particular college are on the staff, however," Mr. Jones said. "It is a question of support and co-operation from the whole Junior class, whose book it is. There can be no partisan issues in putting out a book of the size and scope of the Gopher. All that the staff is considering, now that we have actually begun work, is the support that we receive from the class and the University at large. Loyal support will insure a book that we feel will be hard to surpass."

Asked in regard to features and new ideas which will include the Engineering activities, Mr. Jones refused to make any positive statement, as he considers the annual to be yet in such a formative state that no definite plans which will remain unchanged have been formulated.

"Let me say one thing, though," he said, "and that is that anything that goes into that Gopher, no matter in what section, is going to be good and original and worthy."

CHEMISTS

CLASS OFFICERS

Freshman

President—Kenneth Peterson.
Vice-President—Ernest Gravender.
Secretary—Oscar Lindmo.
Treasurer—Albert Becker.

Sophomore

President—Douglas McHenry.
Vice-President—Harry Doran.
Secretary—Alvin Edmunds.
Treasurer—Ruth Etier.

Juniors

President—Alvin Fuhrman.
Vice-President—Miles Dahlin.
Secretary and Treasurer—Adeline Feig.

Seniors

President—Charles Firth.
Vice-President—Ben Sorensen.
Secretary—Ross Bostwick.
Treasurer—Lee MacMillen.

CHEMISTS HAVE SMOKER

On the evening of October 25, the Chemists had their initial All-Chemists gathering on the top floor of the Chemistry Building. Never before have the chemists had such a large gathering at a Get-together. The room was filled with under-classmen who seemed to be anxious to meet the upper-classmen and faculty.

Knowing that the big object of the meeting was to get the Freshmen acquainted with other members of the school, several stunts were devised by the Social Committee of the School of Chemistry, whereby the Freshmen might come to know other members of the school. The stunts as worked out by Miss Adeline Feig, chairman, were a great success and as a result, the members of the various classes became intermixed.

Included in the program was a short talk by Lloyd Hatch, during which he told of the nature of various organizations in the School of Chemistry. The talk was purely educational in that it acquainted the students with organizations which are open to all students of the school and of those which are honorary. Following Mr. Hatch's talk on Organizations, Prof. R. E. Kirk, a member of the faculty, told of the "traditions" in the school of Chemistry. The Freshmen seemed to appreciate the tradition concerning the hardness of Miss Cohen's course in General Chemistry.

After the conclusion of the program, which was presided over by Richard L. Rademacher, groups of four were formed and a short period of card playing developed. "Smokes" for the men and candy for the women were consumed during this particular period. After the conclusion of the card games, they all went their way.

THE JUNIORS AGAIN

Last spring, when the mind of youth was wont to wander and leave its sense of reason behind, the present Sophomore class presented a challenge to the Juniors to come forth and show their prowess upon the kitten-ball field. And lo, the Juniors came not only forth but first. The Sophs came last. All through the summer they nursed this defeat and vowed that they would avenge it when the time came to strike. So when the time came to repursue our studies, yea, and perhaps catch them, the Sophs indulged in a little secret practice. Again the challenge came, and again the Juniors came and saw and conquered. The only alibi they could present then was that the season was against them, and as it was impossible to change the season the only logical thing to do was to change the type of game. The Juniors got the jump on their inferiors this time and issued a challenge to the Sophs to indulge in the gentle parlor game commonly called football. It would be for the best, perhaps, if what happened were not mentioned, but with past experience staring us in the face, we must.

For three quarters, the Juniors played with them like a cat would a mouse. In the fourth quarter our triple threat began to threaten. Fuhrman's punting was wonderful to behold (that is it was for all except the Sophs), his passing was accurate, resulting directly in two touchdowns, and whenever ten yards or more were needed he got them. Bunger played a good game at quarter, running a green team, while Coult and Johnston starred at the ends. Oh, yes, we almost forgot to tell you that the Juniors won, 20-3.

FROSH, SOPHS FEED

The Minnesota Union was the scene of the festivities which concluded hostile relations between the Freshman and Sophomore Chemists. At a banquet held November 8, the Freshmen paid homage to the superior physical prowess of the Sophs, as evidenced by a football game betwen the two classes, in which the '25 men brought home the bacon. Both classes decided to bury their hatchets and refrain from further hostile demonstrations, at least, until other opportunities for renewal arise.

Speakers at the banquet were Prof. R. E. Kirk, Miss Lillian Cohen, Richard Rademacher, Lyman Coult, and Kenneth Peterson. Douglas McHenry, President of the Sophomore class, acted as toastmaster.

ALL-CHEMISTRY DANCE

An all-chemists' dance is to be given by the Sophomore class of the School of Chemistry at the Maryland Hotel on Saturday evening, December 9. Arrangements are in charge of Ruth Stier, John Dweyer, Dan Hartwell, and Harry Doran. Music will be furnished by a surprise orchestra. Chemists may obtain programs from members of the committee in charge.

ARCHITECTS

OCTOBER DESIGN AWARDS

"A Building for a Firm of Architects" was the title of the Junior Short Problem judged this month. Two Mentions were awarded: to I. Woodner Silverman, and H. A. Magoon.

In the Interior Decoration Short Problem: "The Bed in Several Styles," credits were awarded Gladys Brouillard, Olive Prescott, Florence Knox, and Marion Petri.

The Sophomore Short Problem, "A Pedestal," called for the design of a pedestal and setting for a large seated figure of Minerva. Mentions were received by R. V. McCann, Dorothy Brink, E. W. Krafft, Theo. Jan Prichard, Louis Fischer, Catharine Howard, and Edwin Mollander.

Judgments, this autumn, are being held in the fourth floor store-room, not in the third-floor corridor as has heretofore been customary.

NOVEMBER DESIGN AWARDS

The judgment of the Senior Long Problem, "A Terminal Railway Station and Office Building," is conceded to have been the greatest massacre since that of the Bethlehem Innocents by the late King Herod. There was only one survivor worthy of Mention, namely, M. J. Markuson, who was complimented by the jury for his straightforward scheme, clearly thought out in the original esquisse.

In the Sophomore Sketch Problem, "A Sign-Post for a Suburban Street Intersection," E. W. Krafft and Gladys Herulund received credit plus. Credits were received by Gilman Hollen, Theo. Jan Prichard, R. Rosenberg, A. E. Rigg, Chester L. Carjala, and P. P. Bross.

The Freshman Problem, "A Tablet Commemorating the Work of a Great Architect," in Roman V-cut letters, appeared in the halls this month. A's were received by C. Lighter and R. F. Goranson. A-minus was the award given Da Yu Doon, P. W. Kilpatrick, R. A. Cohen, and J. T. Grisdale.

A special Esquisse-Esquisse was offered to all three design grades on November 10, the problem dealing with "A Typical Lighting Unit for the City of Minneapolis." Two Mentions were awarded in the judgment of the problems submitted in the department: to E. F. C. Backstrom and Glanville Smith. Mr. Backstrom's design took fifth place in the downtown judgment in competition with work done in various architectural offices throughout the city.

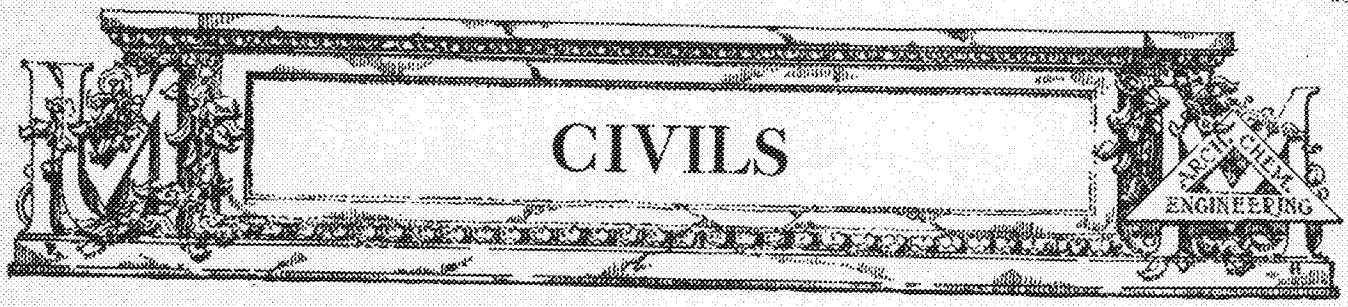
The spirits of Stanford White, La Farge, McKim, and others, descended from Heaven, New York, and elsewhere into the Senior Drafting Room in the stilly watches of the night after all the architects were tucked into bed, and played all manner of ghostly tricks. Not being content with mere table-rapping and such old stuff, they lugged in a box of chalk from the vestibule and made spirit-pictures on the walls. Arabesques, galloping dominoes, blooming liverwort, fried eggs-and-darts, wonderfully beautiful (though crude) Early Christian mosaics, and festoons of hot dawgs appeared from beneath their ghostly fingers.

Nor were they satisfied with these pranks. A spectral humor glinted from their moon-tinged eyes as they drew knowing portraits of faculty members.

"Ha-ha!" cried La Farge in inaudible accents, as he drew in the high lights on R. C.'s Gustavino with a bit of white chalk. "I'll bet the faculty will think the students done this!"

"What grammar!" thought McKim, his lip curling in a ghostly sneer. He was engaged in drawing a handsome thumb on the hand of Professor Mann. Beneath the figure he dashed off, in his typical classical wayical, these words: "Spheres! cried the King." Nearby, another spirit was depicting a lop-sided proscenium arch beneath which a baby-buggy, lately wrecked by some enfant terrible, was being auctioned off, à la the late Junior problem. Professor Forsythe proudly strolled along the mural, pushing another baby-buggy in which sat a bouncing infant engaged in taking a large bite out of the end of a T-square. In the corner, the hallucinations arising from too great a dose of history notes sprawled along the wall, accompanied by this cryptic remark: "It shows considerable—ah—research." The wraiths of Cass Gilbert and Stanford White worked in conjunction on the next panel, where the vision of a foaming glass of skål, retained from a former epoch by means of Cass' well-known photographic memory, balanced the figure of the Dean.

Next appeared Professor Arnal, with the familiar checked suit, Camel, and dripping paint-brush. And he was saying—how did La Farge know it?—"It is a great dif-FIC-culty to wor-rk in such surroundings." And then, in a last burst of inspiration, before the spectral crew melted away into the moonlight again, the figure of Miss Roskilly, attired (the Daily says) "in a Scotch costume," was depicted as cleaving her way heavenwards on a pair of white angelic wings.



PROFESSOR ZELNER TAKES SUMMER TOUR

Last summer Professor Zelner took an automobile tour through some of the North Central States. The following is a brief outline of his trip:

Professor O. S. Zelner left St. Paul July 2 with family and camping outfit. He drove through southern Minnesota and Wisconsin by way of Rochester, Winona and La Crosse. He visited Wisconsin Campus at Madison; to Chicago by Lake Geneva, Waukegan, Great Lakes Camp, and Campuses of Northwestern University at Evanston and University of Chicago. Through to Michigan City, Ind., by Gary and Miller—in the sand-dune country. Through northern Indiana; visited Campus of Angola College, by way of South Bend, Elkhart, Gosben. He stayed in southern Michigan about ten days with old friends and mother and sisters. From there he went to Albion College, Oberlin, Alma, Michigan Agricultural College and University of Michigan. Returned home by West Michigan Pike along east shore of Lake Michigan, through Muskegon, Petosky, Traverse City. Visited site of old University of Michigan Summer Camp, then to Purdue Summer Camp at Puntwater, Mich. Crossed Straits of Mackinac from Mackinac City to St. Ignace. Returned through upper peninsula of Michigan by way of Manistique and Escanaba. At Manistique visited Arden White (C. E. '22), who is with U. S. Lake Survey. Continued across Wisconsin to St. Croix Falls and Taylors Falls. Arrived home August 5.

The student chapter of the American Society of Civil Engineers was very fortunate to have Professor Ira O. Baker, former head of the civil engineering department of the University of Illinois, as a speaker at an informal meeting on Monday afternoon, November 5. The occasion of Professor Baker's visit was the installation of the Triangle chapter at Minnesota. Professor Baker spoke on the subject of "The By-Products of an Engineering Education."

Professor Bass ordered a few new wastebaskets for the senior civil room so that the boys may now keep their room in first class order.

Aubrey Leonard, the star solicitor of the college, says that the civils came across in great style in the Community Drive. Over 90 per cent of all the civils subscribed to the fund. Aubrey's sales talk is something like this: "Well, now, you know it's a good thing and I don't have to talk for it."

Now that the football season is over we note that Ed. Dindorf and Paul DeFreece have taken up chess as their recreation.

ENGINEERING EXPERIMENT STATION

The Engineering Experiment Station, established last year, already is carrying on important research work. During the past spring and summer, C. H. Dow, formerly an instructor in civil engineering, made an investigation of the use of marl in road construction. Professor R. E. Kirk, of the School of Chemistry, has made a study of the use of marl for the manufacture of cement. The results of both of these projects are being prepared for publication. Sven A. Vaule, M. E., 1922, conducted a research relating to action of a rotary pump in pumping oils of different viscosities. This was financed by a fellowship donated by the Northern Fire Apparatus Company.

For the current year, two research fellowships in the Engineering Experiment Station have been awarded. C. F. Olmstead, B. S. (M. E.), 1922, will work under the direction of Professor F. B. Rowley upon heat transmission through building materials. H. O. Halvorson, B. S. (Ch. E.), 1922, will investigate the action of certain chemicals on some of the newer alloys, under the direction of Professor C. A. Mann.

We have noticed that the R. O. T. C. has handed out a few of their police uniforms among the Junior and Senior civils. They are supposed to wear them three days a week, but after finding out that the uniform was good for a free ride on the street car they now wear them every day.

The American Society of Civil Engineers was founded in 1852, and has 10,275 members in the United States and abroad. The requirements for admission are said to be higher than those of any other professional engineering society. Student chapters are maintained in 45 engineering schools in America.

Ralph W. Hammett, Architecture '19, after having taught the freshmen for three years, has gone east on a scholarship, giving up a trip to Europe, and now receives his mail in care of the School of Architecture, Harvard University.

Henry C. Gerlach, Architecture '22, is practicing architecture in his father's office in Mankato, Minnesota.

Frank S. Moorman, Architecture '22, 728 Goodrich Ave., St. Paul, is doing good work in his father's office in St. Paul.

Walter K. Cook, C. E. '22, of Pipestone, Minnesota, is doing structural steel designing in the office of Croft & Boerner, Inc., Minneapolis.

Miss Edna Croft, Arch. '22, who has the distinction of being one of the first girls to graduate from the architectural department at Minnesota, is work-

ELECTRICALS

FIRST A. I. E. E. MEETING

By Philip E. Richardson

More than a hundred enthusiastic students and members of the faculty assembled at the Minnesota Union ballroom for the first official meeting of the A. I. E. E. During the meal an orchestra with real pep played the latest numbers, under which influence the students of various classes ate and were merry and became acquainted with each other.

Roy Olson, president of the student branch of the A. I. E. E., took charge of the meeting. Speeches by Prof. W. T. Ryan, LeRoy Grettum, and Prof. G. D. Shepardson, head of the Electrical Engineering department, contributed much to the success of the meeting.

Prof. Ryan, the first speaker, outlined the nature, organization, purposes and plans of the A. I. E. E., and told of its national prominence in the electrical engineering profession. It has 15,000 members, and 48 local sections. The purpose of the organization is to raise the standard and status of the profession, to promote scientific investigation of electrical engineering problems, and to furnish a medium for exchange of ideas among its members. He urged that each student avail himself of the privilege of becoming associated with this organization and to take an active part in it.

LeRoy Grettum, the second speaker, showed very clearly the advantages to be gained to the student by active participation in the affairs of the society, particularly emphasizing the point that one gets out of a society just what he puts into it. He showed that after a student graduates and gets out in the world, the biggest and most important thing he will have to deal with is other men. To insure success, he must know how to get along with other men, how to bluff them, and how to lead them. What he learns in the classroom about how to overcome and use the forces of nature will be of less advantage to him than the ability to guide and use the forces of men.

Following Mr. Grettum's speech, Mr. Lawrence E. Moline gave a piano solo, which was vigorously encored.

Prof. Shepardson gave the final speech of the evening. He talked about the bright prospects in the future for electrical engineering at the university. He sketched in a very interesting manner the development of the department from its early beginnings as a branch of the physics department, through its many struggles to get proper recognition and the much needed building and equipment, up to the present time when the construction of our new building is assured, and in proportions far beyond the wildest dreams of years ago.

President Olson outlined the plans for the student branch for the coming year and gave instructions concerning membership. The meeting broke up in a mad rush to sign up memberships.

The Electrical Department was one of the first organizations to reach the 100 per cent mark in the recent Stadium drive. The students of the department also made a very favorable showing. A large percentage of the upper classes were members of the 1,500. Irving Marshman, senior electrical, was the Engineering Chairman.

Eta Kappa Nu announces the election of the following men: R. A. Braden, '23; I. H. Marshman, '23; R. N. Williams, '23; W. Wellisch, '23; J. G. Lewis, '24; L. E. G. Mabbott, '24.

Members of Eta Kappa Nu are selected from the upper third of the class, those men being chosen who "by their attainments in college or in practise have manifested a deep interest and marked ability in their chosen life work."

Radio Lecture Course

According to a press announcement, the Universities of Wisconsin, Iowa, and Nebraska, Tufts College and New York University have announced lecture courses to be broadcast from their respective radio stations. Dean Lough of New York University is also quoted as saying that "Loud speakers" are to be used in the various class rooms, so that one professor may lecture simultaneously to several classes. At Tufts College, one feature of the plan is to have a course of popular nature for boys of about fifteen years of age. At certain specified periods the professor will answer by radio the questions which have been submitted by mail.

A Rubber-Eating Bug was found to have attacked the insulation of certain wires in St. Peter's Church in Singapore. Small bore holes were observed in the outer cotton covering, and the rubber beneath had been completely removed. The fire hazard attendant upon electrical installation is greatly increased, and the rubber in warehouses is endangered by the existence of such a peculiar insect. So far entomologists have been unsuccessful in locating the offender.

CHEMISTRY MANUFACTURE

(Continued from page 11)

steam jacketed kettles. 7. Chemical proof enamel pan evaporators. 8. Vacuum drier. 9. Atmospheric air drier. 10. Hydraulic press. 11. Nitrator. 12. Sulphonator. 12. Glass enameled still with agitator. 14. Duriron still with agitator. 15. Double effect evaporator. 16. Reducer. 17. Autoclave. 18. Digester. 19. Fusion pot. 20. Various types of furnaces—gas, oil, surface combustion, electric, etc.

The course in Chemical Manufacture makes use of all the student's previous training. He learns the use and value of the library. In the laboratory he makes use of his analytical chemistry, both qualitative and quantitative, and in operating the equipment, his training in shop, heat engines, and electrical engineering comes into play. But most important of all is the training he receives which shows him the intimate correlation between his chemistry and his engineering subjects, and the economic problems connected with the manufacture of chemical products.

A. E. S. SMOKER

The first meeting of the Association of Engineering students was held Friday, October 20, in the engineering auditorium. The Association was host to the freshman class. The smoker was held to get the freshmen acquainted with the upper classmen.

Several talks were given by upper classmen. LeRoy Grettum "thru" his "wicked line" as usual, and Roy Olson checked in second for the honor. This was due, no doubt, to the fact that Olson did not get a chance to retaliate.

Dr. Hohman, faculty advisor of the Association, gave a talk straight from the shoulder, an insight into college life. Everybody agreed that "Doc" can sure spill the "dope."

The entertainment was furnished by engineering talent. Clifford Nyvall sang several solos and "Doc" Miller "tickled the ivorys" until the old music box "walked the dog." Oh boy, the engineers are there.

The committee on "nurishment" reported a good turnout, as was evidenced by the rapid disappearance of cider and pretzels. Cigarettes were passed and the engineers seemed to have no difficulty in burning the "incense."

H. H. Cochrane of the Montana Power Company estimates that only about one-fourth of the available water power is being utilized in that state; that about 663,000 kilowatts are being wasted through lack of development.

MECHANICALS

PROF. SHIPLEY SPEAKS TO THE A. S. M. E.

Professor S. Carl Shipley, Superintendent of the mechanical engineering shops and Professor of Machine Construction, was the principal speaker at the second meeting this year of the University of Minnesota Section of the American Society of Mechanical Engineers, which was held on Saturday, November 18, in the Main Engineering Auditorium.

President C. F. Olmstead, of the local section, opened the meeting with a brief address and introduced Professor Shipley.

Professor Shipley gave an illustrated lecture bearing upon his recent experiences in Constantinople, Turkey, where he has been Director of the Engineering Department of Roberts College for the past two years. The lecture covered a number of interesting historical events and a description of several examples of ancient and modern engineering and architecture. His discourse was marked by a number of stories of the natives of Turkey, their customs and habits.

A record crowd attended the meeting, which was open to the University public.

PI TAU SIGMA ELECTIONS

Pi Tau Sigma, honorary mechanical engineering fraternity, announces the election of the following men:

Seniors: Arthur Gilstad, Arthur W. Sear and Delton T. Waby.

Juniors: Joseph A. Anderson, Charles R. Blodgett, Lloyd P. Grobel and Harley R. Langman.

Election to Pi Tau Sigma is based upon excellence in scholarship and ability to apply engineering principles to practical problems.

Grant C. Bergsland and Shelden S. Hibbard, of Minnesota Gamma Chapter of Pi Tau Sigma, were delegates to the National Convention of the fraternity, held at the University of Wisconsin on November 10 and 11, 1922.

The Forty-third Annual Meeting of the American Society of Mechanical Engineers, which will open on December 4 in New York City, will comprise twenty-two sessions dealing with both theory and practice in the various branches of mechanical engineering. This meeting will last four days, and will be followed by the National Exposition of power and mechanical engineering to be held at the Grand Central Palace in New York City.

A. S. M. E. NOTES

C. F. Olmstead, president of the local student section of the A. S. M. E., has announced that Mr. Charles L. Pillsbury, prominent Minneapolis business man and engineer, will be obtained as soon as possible as a speaker for the A. S. M. E.

Membership in the local student section at the present time is as follows:

Seniors	100% membership
Juniors	90% membership
Sophomores	81% membership

The total membership is about 90 per cent of the total enrollment in the mechanical engineering department, and is expected to become 100 per cent upon completion of the membership drive.

Professor J. J. Flather, head of the Mechanical Department, has been appointed Chairman of the Student Relations Committee of the Minneapolis Section of the American Society of Mechanical Engineers. Other members of the committee are Carl A. Herrick, John H. Brown, C. Floyd Olmstead, and Sven A. Vaule.

Governor James Hartness of Vermont, Past-President of the American Society of Mechanical Engineers, has written an article for the A. S. M. E. Journal of November, 1922. The subject of his article is "Influence of the Machine Tool in America."

He shows that, with the introduction and development of the machine tool and its product, machinery, have come many unpleasant industrial affairs—the result of lack of proper attention to industrial, financial, and business affairs.

Governor Hartness stresses the fallacy of permitting the Government—composed of men elected by popular ballot—to handle matters of engineering, finance, and farming, whereas it was intended, originally, to maintain peace and protection for the country.

A. S. M. E. Power Code

Professor J. J. Flather, head of the department of Mechanical Engineering, a member of the American Society of Mechanical Engineers' power code committee, is preparing a code on power measurement. This code will be endorsed by the society, and it is expected to be universally accepted by engineers for standardized testing. Professor Flather has made extensive investigations on dynamometers and is considered a national authority on the subject of power measurement.

BLASTING AT BETHLEHEM

(Continued from page 9)

holes, the total charge per hole, and the desired height of the charge in the hole, must be considered in deciding on the most advantageous deck loading. The experience and judgment of the man in charge must be relied upon in this phase of the preparatory work. If the charges are properly spaced in the hole, greater efficiency is obtained from the explosive and the rock is broken better for loading into cars. The work was done by four crews of about four men each, with a man directing each crew.

Loading the holes was a full day's job. It took some time for the men in the different crews to get organized and to understand just what they were to do; as the day progressed the speed of loading increased. By the time the holes were all loaded and tamped, the quarry bench cleaned up, and the cordeau connections made, it was after six o'clock.

Then came the blast. One electric cap was connected to the end of the cordeau and fired by a blasting machine. Like a pile of building blocks pushed over by an impatient child, the great quarry face tumbled down, the rocks spilling over one another and settling at a comfortable angle of repose at the base. The nearby highway, railroad tracks, and high-tension transmission line were not touched by flying rock, so correctly had the charges been calculated. By this shot 22,000 pounds of dynamite broke down 83,671 tons of limestone, or almost 4 tons of stone per pound of dynamite.

No thinking person can fail to pause for a moment's deep reflection when he sees nearly 100,000 tons of stone broken down in an instant into pieces small enough to be loaded into cars. It is an overwhelming demonstration of the power of dynamite—the great constructor of civilization—which has been so aptly termed *the New Aladdin's Lamp*.

The following day our service representatives returned to the quarry for a consultation with the management on how best to drill the holes for the next shot. They were, of course, pleased to hear that, from all appearances, the work on which they had assisted had resulted in one of the best blasts ever made at this quarry. The number of large rocks requiring secondary blasting was exceptionally small, and the pile of broken stone had been laid down on the quarry floor in nice shape for loading by big electric shovels.

TRIANGLE CHAPTER INSTALLED

Chi Sigma Tau, local engineering fraternity, was installed as Minnesota chapter of Triangle, national engineering fraternity, Saturday and Sunday, October 28 and 29. Installation ceremonies conducted at the chapter house, 1227 Fourth Street Southeast, culminated in an installation banquet at the Curtis hotel Sunday evening.

Triangle chapters at Wisconsin and Iowa, with the national executive committee, were represented on the installing delegation. Active Triangle chaptrs now are located at Purdue, Illinois, Wisconsin, Ohio State, Kentucky, Cincinnati, Iowa and Minnesota, with an alumni chapter house at Chicago.

Harry Korslund, Arch. '18, passed through Minneapolis early in October on his way home to Iowa, for a month's vacation. He will return to Duluth, where he is with the firm of Germann & Jensen, architects.

TECHNICALITIES

HOW TO OPERATE A SLIDE-RULE.

(In Four Slips)

Prof. Noah Webster defines a slide-rule as follows:

Slide (derived from Egyptian Cleopatra): To slip—to glide—to pass smoothly.

Rule (ancient Hebrew): An instrument—a rude process of operation.

Hence, slide-rule, an instrument used to pass a course smoothly by a rude process.

A slide-rule is like a woman. It is skiddish and no one ever learns to manage one. It has a variety of figures, which are more or less true. Its beauty is only skin deep, but like a woman at a dance, it has sines on its back. Men are crazy to get one, but after they do they wish they'd saved their money.

SLIP ONE.

Obtaining a Slide-Rule.

In order to impress your friends and your girl that you really are an engineer, determine to secure a good rule. Get one, either beg, buy, borrow or steal it, with as many numbers and scales on it as possible. The more the scales, the bigger the impression. Get a magnifying glass on the scale by all means. Your errors will be more accurate.

SLIP TWO.

Carrying the Slide-Rule.

After first obtaining the slide-rule, letter your name, address, telephone number, home address and reward offered on the case. Take the rule with you everywhere. Wear it in your right-hand coat pocket, or, as many prefer, in your inside coat pocket. In the latter instance, the rule should be canted about 45 degrees. This will give the wearer that devil-may-care appearance so desired.

SLIP THREE.

Fundamentals of Operation.

Remove the slide-rule from the case. Remove the glass indicator and let drop easily from a height of about 10 feet onto a hard surface. Iron, concrete or brick is suggested for this. Buy a new glass and place a standing order for one a week. Work the slider backward and forward in the rule until it slips easily from one mark to another. If the rule sticks, whittle off a half inch and try again.

SLIP FOUR.

Calculations.

Take some simple number, such as two, seven, eleven, which you know at sight and are familiar with. Follow directions closely. Place the indicator and the slide over the same number on the lower or 'D' scale. This takes time to perfect, but must be learned thoroughly. Now, if you wish to multiply two by three, for instance, place the indicator over three on some other scale, and read your [illegible] find that somewhere along the line you get a six, repeat until the answer is 5.95, or nearly. A little practice such as that will soon wreck your arithmetic, but you won't need it anyway. The next important thing is the decimal point. Here is a simple method. If your grandmother and grandfather were married in 1842, place the point after the second figure, but if the moon is made of green cheese, place the point before the sixth figure. In any case you will be wrong and have to check by longhand.

—Illinois Technograph.

"Izzy, Izzy, tell your papa.
How much cash is two times four?"
"Two times four is nine, dear papa,"
Thus spoke little Isadore.

"Don't you know that two times four
Is eight?" said papa, with a frown.
"Yes, I know, but I said nine
Just so you could jew me down."

—A. W. K.

Co-ed (dancing with young engineer): "Do you shave yourself?"

Engineer: "Why-er yes."

Co-ed: "I thought so, you seem so rough."

A certain railway engineer who had made a complete study of the oil losses on his particular run, made it his first duty to instruct new firemen in the care of oil so as to eliminate these losses. On one occasion he was quizzing a new fireman on the duties of his post.

"What would be the most important thing to do in case of an unavoidable head-on collision?" he queried.

Without a moment's thought he shouted, "I'd shut off the lubricator, grab the oil can and jump."

Frosh engineer: "My landlord is certainly a fine fellow."

Upper classman: "What's he going to do for you?"

Frosh engineer: "Why, he said if I couldn't pay my room rent, he'd help me out."

"How are your brothers?"

Young brother: "Just fine."

Post Grad: "What are they doing now?"

Young brother: "Oh! One is an engineer, and the other one works."

Freshman Ag (to young engineer): "Now that incubators are being used so much by farmers, it won't be very long before they'll do away with the hen entirely."

"Joe is a grouchy, pessimistic cuss, isn't he?"

"He sure is. Why that bird would look for splinters in a club sandwich."

FRESHMAN THEME NO. 2

Famous Institutions—For Instance, Our Post Office.

Snuggled among the drooping oaks, maples, elms, box elders, and cigarette butts of the University campus, there is a building, not big, not very small, but built of red brick. This building, which is built of red brick, contains the Business College.

Also, in this red brick building is one of the leading institutions of the University (i. e. the Post Office). When one enters the campus, bright and early in the morning, the first sight one sees among the green foliage of the above mentioned trees, is the red of the brick tower of this building. And when leaving the campus at night one sees the scarlet of the sunset mingle with the brick red of the Business College tower.

But to return to the Post Office. In fact, the principal occupation of many students is—returning to the Post Office. The Post Office serves two purposes. The original, but now subordinate purpose, was to facilitate the rapid distribution of mails, males, and all such et ceteras. But now, since the numerous No Parking signs have been placed on the campus, it serves as a place where academics may stand around. This year it may have a new use. A Soph told me the Arabs were going to hold their play in the Post Office, because they ought to be able to seat a large crowd when there are 5,000 boxes.

It is one of the joys of my life to enter the Post Office at 12:20, to see the vast surging mob of hansom men, and beautiful females; to plunge into that mob; to struggle and fight my way through, the light of battle in my eye, and the smell of powder in my nostrils; to arrive at my box, panting and weary; to thrust aside a co-ed, who thinks other people's boxes are made to lean on; to open my box, and to find nothing.

"My good man, you had better take the streetcar home."

"Sh' no ushe! My wife wouldn't let me-hic-keep it in the house."

The Fair One: "I see here where a man married a woman for her money. You wouldn't marry me for money, would you?"

The Square One: "Certainly not. I wouldn't marry you for all the money in the world." —Michigan Technic.

P. S. (by us): Don't ever try the above on a girl. I did once and I am warning you.

Civil: "Does your new girl know much about automobiles?"

Mechanical: "Heavens, no, she asked me if I cooled the engine by stringing the gears."

THE TECHNOLOG'S GENERAL DUMBNESS TEST.

Those who can answer the following general questions in less than 6½ minutes, and get a grade of 98 or better, should be able to get E in any course offered in this college. These are all facts every Engineer should know.

I History

1. Did Columbus Ohio discover America? If so, what did he think of the flappers?
2. Since Socrates founded the first University, was he the first campus Greek?
3. When was 1776?
4. When Adam got his only shirt back from the wash, where was the Missing Link?

II Geography.

1. Bound the following states: Iowa, Anoka, Hawaii, Intoxication.
2. In what range of mountains are Guard Mount and Jim Hill?
3. Is it possible to get a Kentucky Derby at Wormser's?

II Science.

1. If 2 and 2 are 4, how much is 6?
2. Since all the above is true, how old is Ann?
3. An Engineer weighs 148 lbs., and knows 76 co-eds; now if he should enter the Post Office at 12:21, when would he get out?

IV Rhetoric.

1. The sea is ——— (pink, yellow, dry, thick). Underline proper word.
2. In a University there are many —— (sweet, dumb, tall, more, damn) co-eds.
3. I ——— (was, is, won't.)

V Swedish.

1. Ay tank ay skoll go bed? (Translate.)

ODE TO THE SENIOR CIVILS.

The boy stood by the burning deck,
As up in smoke it shot.
For all night long he'd played, by heck,
And never won a pot.

INSTINCT.

Abe Finkelstein, who has discovered a burglar in his house: "Hands up, or I'll shoot."

Quick-witted Burglar: "Fifty dollars for the gun."

Abe: "Sold." —Case Tech

Problem in Stresses: If you have a vacuum tank resting on a beam, what kind of load is it?

The Only A Student: "'Sno load!"

THE MORNING AFTER THE JUNIOR DANCE.

"I had an awful nightmare last night."

"Yes, I saw you with her."

Co: "I have a cold or something in my head."

Ed: "Probably a cold."

—Michigan Technic.

"Professor, can a man live without brains?"

"Why, are you feeling unwell?"

—Michigan Technic.

"Henry, have you turned on the gas?"

"Yes, can't you smell it?"

—Purple Cow.

"Gladys must be a pretty wild girl."

"How so?"

"I heard her father say he couldn't keep her in clothes."

—Georgia Technique.

THE NEW UNIVERSITY LIBRARY

(Continued from page 5)

The book capacity of the stacks as designed at present will be about 1,250,000 volumes. Provisions are made for expansion so that approximately 1,750,000 may be accommodated.

New Departure in Construction

The skeleton frame of the building is of reinforced concrete. This is a departure from the typical construction used in the buildings on the new campus in which the walls are carried up to support the floors, columns being used only in the interior. The floors are of steel tile with concrete joists.

Occupying a position equal to that of the Chemistry building with respect to the Mall of the Greater Campus Plan, it is obvious that the exteriors should harmonize. In general mass, the buildings will be quite similar. In detail, the library will have characteristic refinements. Two-story windows, with steel frames and sash, will express the reading rooms. Modification of the cornice design will add to the interest of the exterior.

The interior of the building throughout will be finished with simple and dignified decorations and substantial furnishings. The public rooms are to be finished in marble with ornamental plaster ceilings. The floors will be of marble and tile. The walls of the main reading rooms are to be faced with a stone quarried at Winona resembling Italian Travertine. Linotile floors are used to aid in sound-deadening.

Mechanical equipment plays an important part in the development of the design. A recirculating system of ventilation arranged to operate in units is to be installed. This will allow the various portions of the building to be ventilated independently of each other.

Building Will Cost Almost a Million and a Half

To date, contracts have been awarded to the amount of $1,350,000.00, and about $100,000.00 is to be expended in equipping the building in all its departments.

It is anticipated that the building will be completed and ready for use about September 1, 1923.

It is apparent that no thought has been spared and that no detail has been overlooked to make the new library building so complete and so modern in its entirety, that it will not be surpassed by any institution in the country in its facility for effectively serving the student body.

ARCHITECTS HAVE TWO NEW INSTRUCTORS

Two new members have been added to the teaching faculty of the Department of Architecture this autumn: E. L. Young, instructor in freehand drawing, and J. W. Dawson, instructor in elements of architecture. Mr. Young comes to us from Chicago, while Mr. Dawson is an alumnus of the department.

Carl E. Johnson, whose position is now filled by Mr. Young, has gone to New York City for further study. Ralph Hammett, whose position is now filled by Mr. Dawson, is also in the east. He is doing post-graduate work in architecture in the Harvard University department of fine arts. His trip to the seaboard was accomplished via the Great Lakes route.

David Denine, Arch. '19, is practicing architecture in Coleraine, Minnesota.

E. E. Forsberg, Arch. '18, is in the downtown office of Professor F. M. Mann.

Mrs. H. M. Quigley (nee Louise France), Arch. '20, is now in Peking, China, doing research work for the University of Peking.

PORTRAIT OF J. DALTON BY JOHN LONSDALE

The Quaker *who made* Chemistry a Science

CAVENDISH had shown that two volumes of hydrogen and one of oxygen always combine completely to form water and nothing else. Proust, a Frenchman, had proved that natural and artificial carbonates of copper are always constant in composition.

"There must be some law in this," reasoned Dalton (1766-1844), the Quaker mathematician and school teacher. That law he proceeded to discover by weighing and measuring. He found that each element has a combining weight of its own. To explain this, he evolved his atomic theory — the atoms of each element are all alike in size and weight; hence a combination can occur only in definite proportions.

Dalton's theory was published in 1808. In that same year, Napoleon made his brother, Joseph, king of Spain. This was considered a political event of tremendous importance. But Joseph left no lasting impression, while Dalton, by his discovery, elevated chemistry from a mass of unclassified observations and recipes into a science.

Modern scientists have gone beyond Dalton. They have found the atom to be composed of electrons, minute electrical particles. In the Research Laboratories of the General Electric Company much has been done to make this theory practically applicable so that chemists can actually predict the physical, chemical and electrical properties of compounds yet undiscovered.

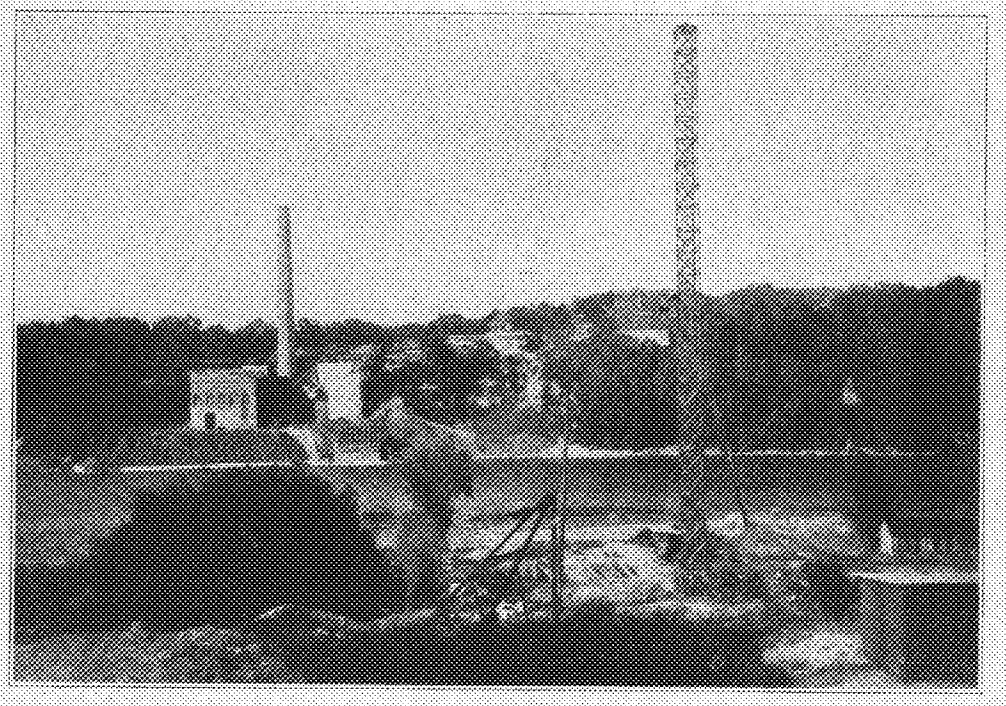
In a world of fleeting events the spirit of science and research endures.

General Electric Company

General Office Schenectady, N.Y.

93-620-HD

MINNESOTA TECHNO-LOG



JANUARY 1923

PUBLISHED MONTHLY DURING THE SCHOOL YEAR BY THE STUDENTS OF THE COLLEGE OF ENGINEERING AND ARCHITECTURE AND THE SCHOOL OF CHEMISTRY.

VOL. III UNIVERSITY OF MINNESOTA NO. 3

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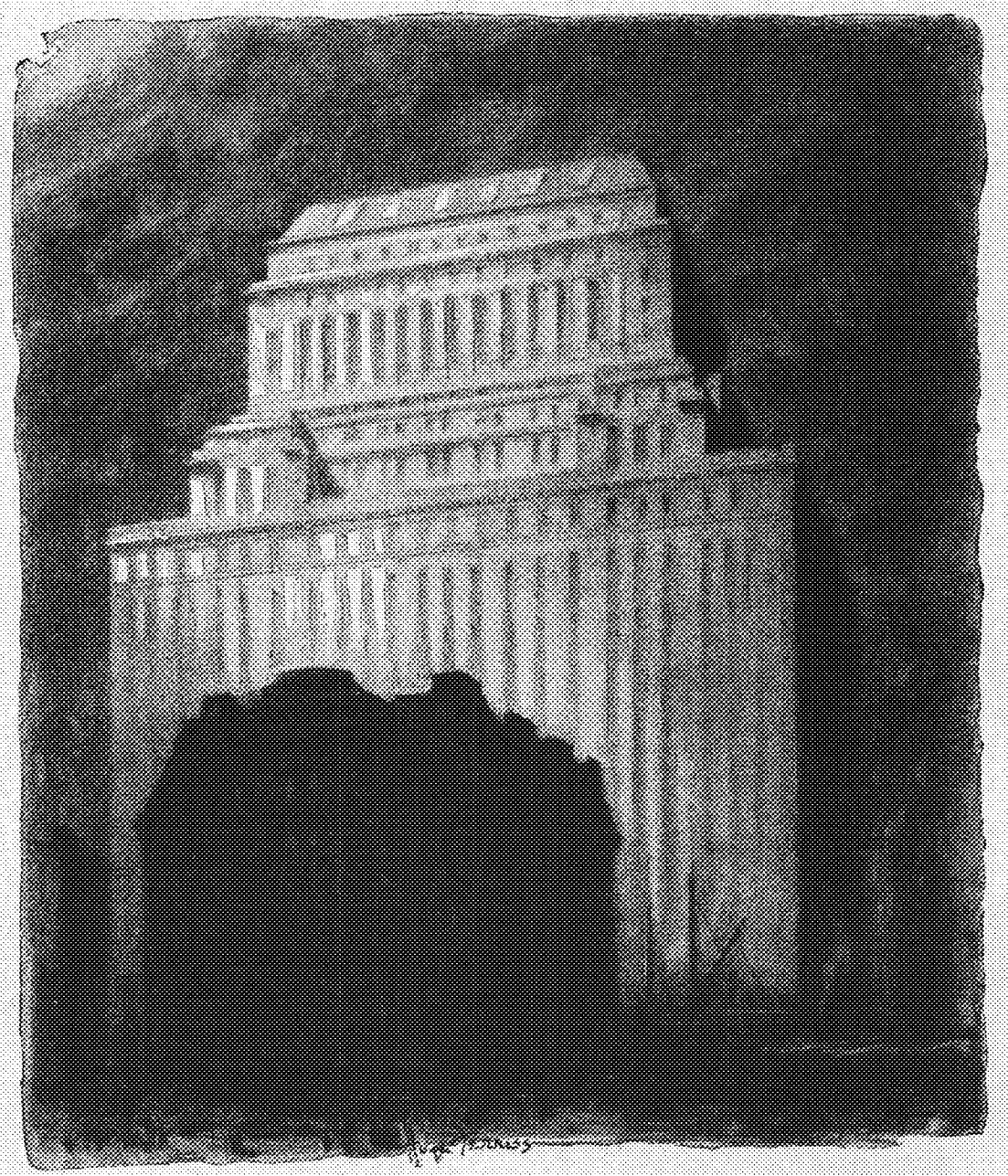

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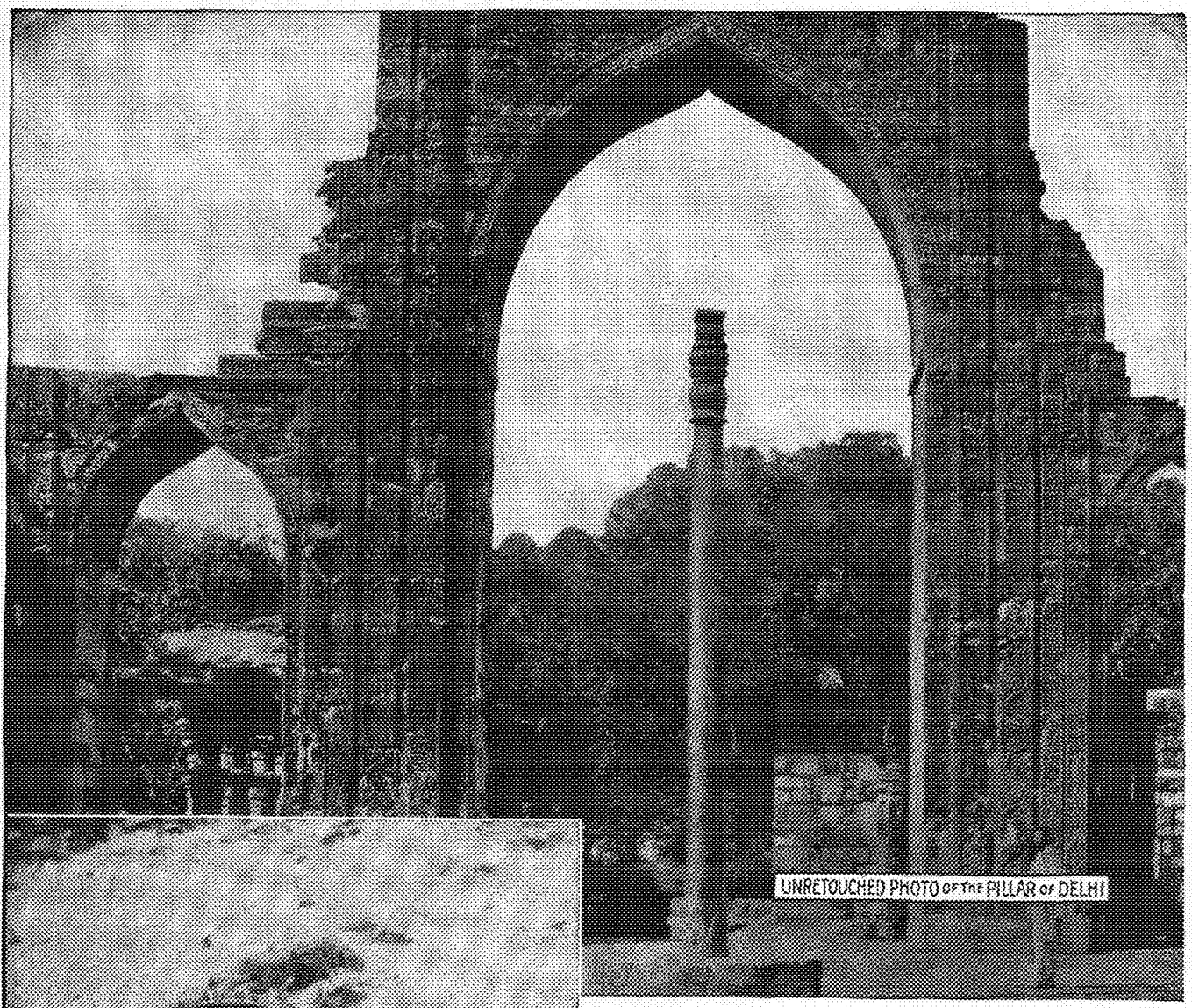
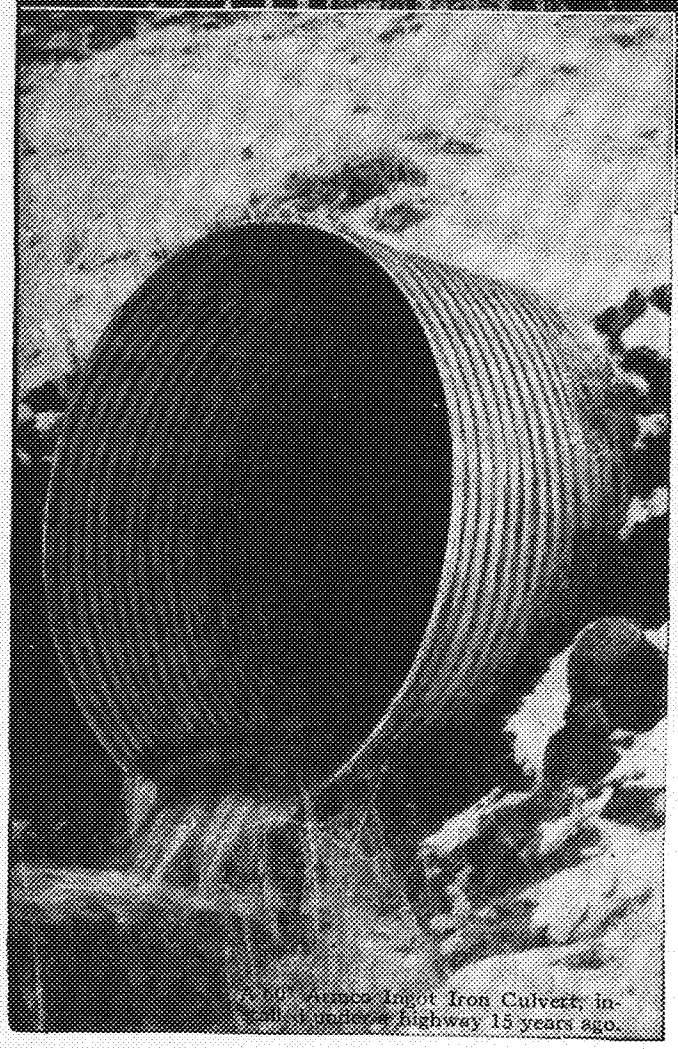


UNRETOUCHED PHOTO OF THE PILLAR OF DELHI



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INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

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MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME III | JANUARY, 1923 | NUMBER 3

'N. P.' BRIDGE NEARING COMPLETION

Track Removal Will Be an Important Step in the Greater Minnesota Plan

By Albert W. Morse

The author wishes to thank Grant Smith & Co. and the American Hoist & Derrick Company for the use of their photographs.

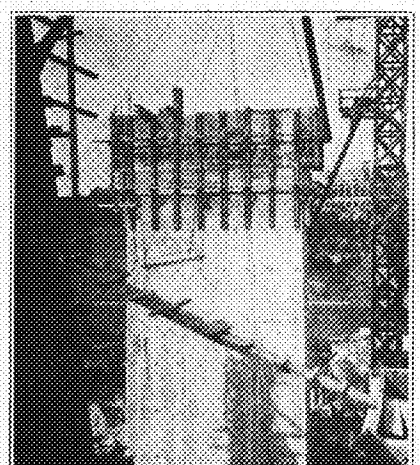
WITH a large amount of construction under way on the campus, the average student is inclined to overlook the new Northern Pacific railway bridge, now well under way, spanning the Mississippi river, just above its predecessor, which has been in use since 1886. It is of the same type as the old one, designed by the late F. W. Cappelen, former Minneapolis city engineer, when he was bridge engineer of the Northern Pacific.

The entire undertaking of changing the right-of-way through the campus entails an expenditure of a million and a half dollars, including $400,000 for replacing and tearing down the old bridge. Industrial development of the last thirty-six years is shown by the substitution of concrete for stone and by the provision for carrying heavier types of locomotives now in use.

Same Type as Old Bridge

The steel superstructure will rest upon eight concrete supports, six piers and two abutments, numbered consecutively from east end. Abutment 8 and Piers 7 and 6 lie on an eight degree curve of 720-foot radius, and Piers 5, 4, 3, 2 and Abutment 1 are on a tangent to the curve. There will be 249-foot spans between Piers 3, 4, and 5, 90-foot spans between Piers 5, 6, 7, and Abutment 8, an 85-foot span between Piers 2 and 3, and an 80-foot span between Abutment 1 and Pier 2, with a total length of 942 feet from bank to bank, and an approximate distance of 90 feet from the track level to the river. The west approach will be over a 300-foot fill, 250 feet being 12 feet above the ground level, and the remaining 50 feet averaging 45 feet. The fill will reach to Abutment 8 and toe out to Pier 7.

In securing the original location of the bridge, Bill Handsaker, resident engineer, used three sets of triangulation with separate base lines, checking them later



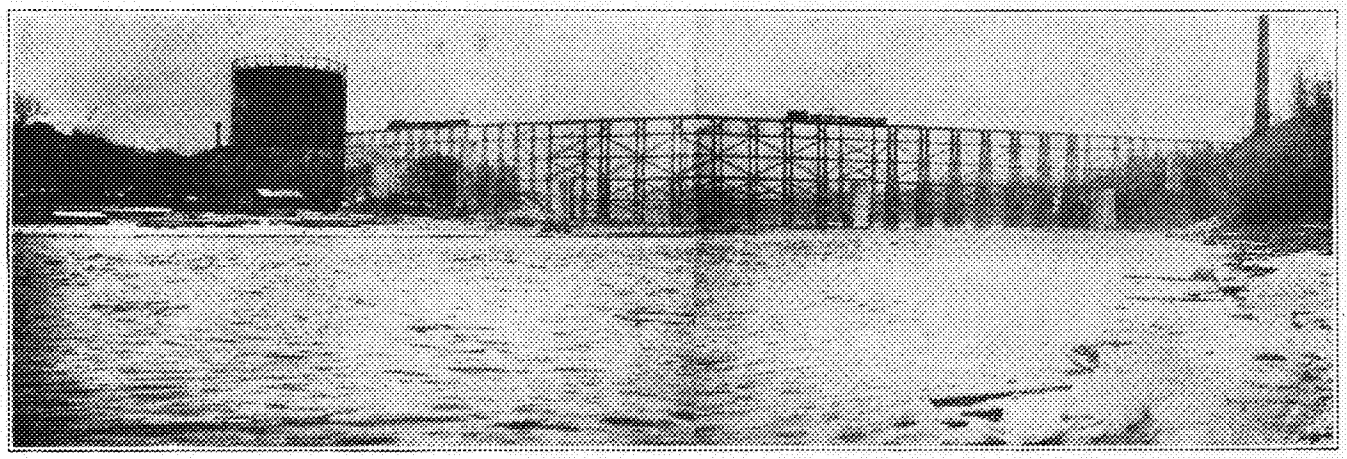
Pier No. 7—Showing the Sliding Forms Used.

and another several feet out. This enabled the carpenters to work from pier centers instead of corners.

Excavation was begun for the east side piers early last May by Grant Smith & Co., who are doing all the foundation and pier work under the general supervision of M. F. Clement, Northern Pacific bridge engineer. An orange-peel bucket was used at first, but after going down a short distance the large number of boulders kept it from getting a firm hold of the material. Danger to workmen from rocks slipping through the bucket and the extra drops necessary to fill it necessitated the substitution of skips. The first concrete was poured by the end of the month, and after completing Abutment 1 and Piers 2 and 3, the equipment was moved across the river.

Rock Level Unreliable

Test holes revealed the general nature of the ground, but irregular structure of the sand rock sometimes required additional excavations as far as five or six feet. The old reliable "wheelbarrow brigade" began the excavation of each pier. When caving commenced, sheet piling was installed, extending in successive sections to the top of the sand rock, which was loosened by blasting. Each pier and abutment rests on rock, the average distance below the ground being 25 feet, and the average footing 25x45 feet. As the work progressed, Wakefield piling was driven to the desired depth. Exceptionally heavy struts and whaling were used to prevent accidents. In all piers below the water level, from two to six centrifugal gasoline and steam pumps of assorted sizes were used. The first pourings were generally without forms, filling the holes dug in the sand rock. Mats were poured continuously, eliminating joints or breaks. The second and third were poured rough with forms, and above these a smooth surface was secured with shaft-sliding forms. Concrete was carried on planks from the plant to Abutment 1. Piers 2 and 3 were poured by a chute on the hillside without a tower, until the tops of the forms were built, and then the concrete was wheeled



A Matched Photograph of the Entire Structure.

side were poured from a 185-foot tower, made of 6x6 timbers braced with 2x8's. Material was delivered in tram cars by gravity to the mixer at the foot of the tower from the bunker half way up the hill. It was then hauled up an incline to the top of the mixer, and after being prepared was hoisted up the tower to chutes at various levels leading down to the forms. A mixture of one part cement, three parts sand, and five parts gravel was used in Piers 3, 4, and 5, and parts of one, two, and four were used in Piers 6 and 7, Abutment 1, and the 2-foot bridge seats where the load will be directly placed. Piers 3, 4, and 5 consist only of concrete, but 6, 7, and 8 are extensively reinforced. The footings of Piers 2, 6, and 7 are strengthened by seven steel rods running from corner to corner. A total of 7,800 cubic yards of concrete has been used in the piers and abutments. Excavations were completed the first week in November, and by the 24th of the same month the last concrete was poured, averaging 35 days in the construction of each one.

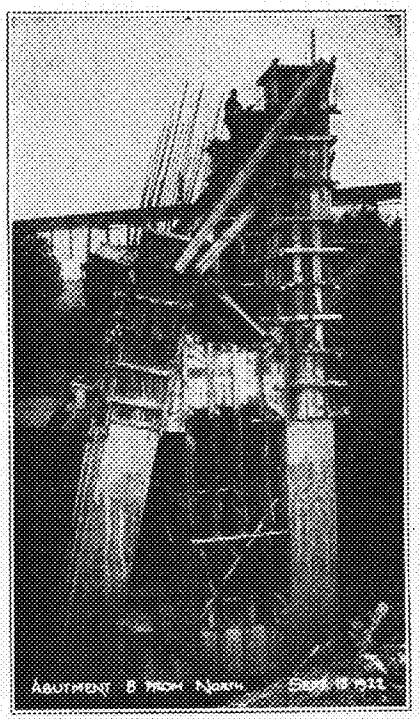
Water Caused Trouble

Pier 7 was the most difficult to construct. Unforeseen trouble was caused by water pressure, the inflow making large holes resembling water mains. This caused an unexpected delay of two months in the work, and it was necessary to operate five pumps, one 10-inch, two 4-inch, one 8-inch, and one 6-inch, continuously. The sand rock level under this pier dropped abruptly at the west side, and it was necessary to place the footing 34 feet below the surface. This is the tallest pier, being 97 feet from the bottom of the footing to the top. It required more intricate forms, and spading the concrete inside was slow because of the large amount of reinforcing steel.

Some difficulty was caused by Pier 4 because of the constant pressure of water and the necessity of placing the footing 22 feet below the river's surface. The cofferdam was banked with oily waste thrown away by the adjoining plant of the gas company. Water disintegrated the sand rock as soon as it was uncovered, so the concrete was placed under water with a dump-bottom bucket. Later on it was carried to the top of the pier by dinky cars and dropped in. Cold weather set in before its completion, and several salamanders were used to protect the last two pourings from frost, the specifications calling for a temperature of at least 40 degrees.

Abutment 8 Well Reinforced

Abutment 8 is perhaps the most interesting feature of the bridge. Its vertical wall is braced by a slanting member to carry the thrust of earth pressure. With the exception of the perpendicular wall's west corner, the entire abutment rests on sand rock. The level of the rock dropped off suddenly at this corner, and gravel is used as a foundation. Because of the load which this abutment must carry, its footing is 50 feet square and lies 24 feet below the surface. It is heavily reinforced, containing 60,000 pounds of steel as compared to 25,000 pounds in all the others combined. Its type of construction has a close resemblance to that of an office building. Two wing-walls, 17 feet high and 20 feet long, will be added to this abutment.



Abutment No. 8—With Upper Forms in Place.

Continual dumping of glowing and partly burned coal from the University power plant has built an extensive, smouldering fire on the river bank like the slow fires of Pennsylvania's coal fields. The workmen had to contend with this. Even in midwinter, at 30 below zero, the surveying crews had to shift around to keep their shoes from burning. The construction of Pier 2 was in some measure hampered by the ash dump, and the heat

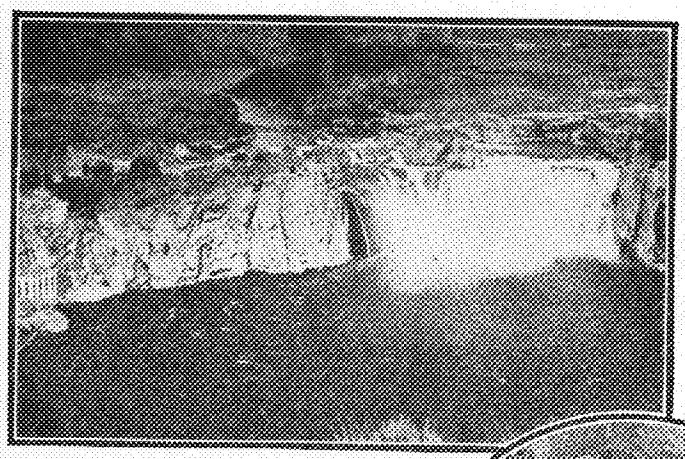
(Continued on page 26)

NATIONAL ELECTRIFICATION

Field of Electric Power Engineering Still in Undeveloped Stage—Has Great Possibilities

By William H. Easton, Ph. D.

ELECTRIC Power is the basis of modern civilization. With it, waste places can rear thriving cities; the jungle can become a pleasure ground; and the desert can bring forth abundance. Without it, no country, however rich, can hope to emerge from a state of semibarbarism. This fact is now universally recognized, and all progressive nations are either developing their power resources or are planning to do so. In consequence, there has come into existence within the past few years a branch of engineering that may be called "national electrification."



National electrification is quite distinct from the building of a number of power plants. It is the planning of an electric power system that will use a nation's power resources to the best advantage and will distribute this power in the most economical manner to put it to the greatest number of uses.

The old unsystematic method of electrification is exemplified throughout the eastern part of the United States, where electric power plants were only established in the towns and cities where there was an immediate demand for power. As a result, electric service is confined almost entirely to the thickly populated areas; while the country at large, and especially the farming districts, is not only without power but has little hope of getting any for many years to come. There are thousands of plants scattered all over this region, but most of them are small and inefficient; and the cost of making power with them is two or three times as much as is the case with a large modern plant.

The new method of electrification is best illustrated by the State of California. Had this State pursued the same methods as New York her electrification would have been confined to small sections immediately surrounding San Francisco, Los Angeles, and some of the larger cities. But the accompanying map of California's main power lines shows something very different. Instead of a number of small, independent plants, there is here an immense unified system that covers the entire state. The network of power lines forms a vast reservoir into which scores of generators pour their energy and from which almost any inhabitant of the State can draw electricity for any purpose.

Such a system of interconnected generating plants is called a "super-power system." It is usually based on water power; but if there is not enough water power to satisfy the demand, one or more large steam plants, located where they can be conveniently supplied with fuel and water, can be included in the system and operated whenever their output is desired.

A super-power system has numerous advantages over the old method of supplying electric power by means of independent plants, as follows:

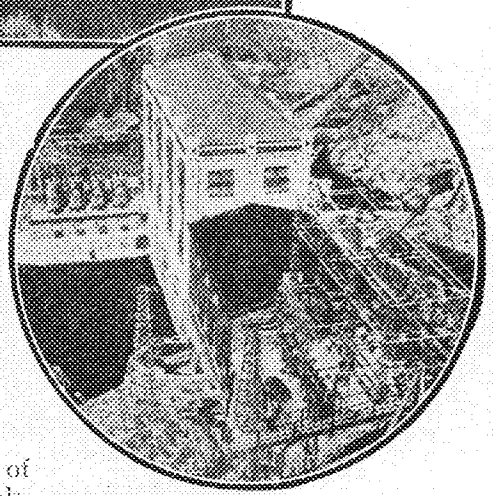
It supplies practically the entire country with electric power and not merely certain limited areas.

It permits the full use of all the water power of a country and reduces the consumption of fuel to a minimum.

It is not dependent upon the water supply of any single district. Though most water powers have seasonal variations, they are rarely all low at the same time; so by connecting several together, the chances are that a power shortage at one point will be made up elsewhere.

If steam plants are required, they can be of the large modern type which generate power at the lowest cost.

It tends to distribute the population and to make all parts of the country prosperous, instead of concentrating all industries requiring power into congested areas and leaving farming areas without power.



Water power is an important factor in a country's prosperity. The proper use of water-ways will eventually lead to cheap power. Cheap power means low priced products.

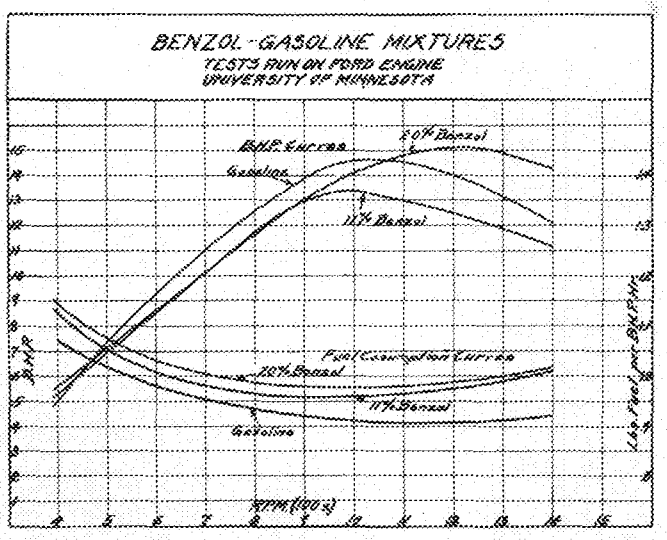
It makes many irrigational and water supply undertakings feasible because it is able to utilize the power developed by such undertakings.

So great, indeed, are the advantages of the super-power system, that several of the leading nations, including England, Japan, Canada and the United States, are preparing to undergo the costly process of revising their power systems in accordance with this method. In the United States, a commission appointed by Congress has submitted a plan for a super-power system for the important district lying between Boston, Mass., and Washington, D. C. This system is to utilize all of the local water powers

BENZOL-GASOLINE FOR AUTO FUEL

Tests Run in Automotive Lab Fail to Reveal Any Superiority in Commercial Mixtures

By Paul W. Rhame



Graph of Results of Tests on Benzol-Gasoline Mixtures for Use as Fuel.

THERE is considerable interest in automobile circles regarding the merits of benzol-gasoline mixtures. Benzol or benzine is a by-product in the manufacture of coke. After the removal of tar and ammonia from the coke oven gases, benzol is separated from the illuminating gas by absorption in so-called "straw oil," from which it is later distilled. The amount of benzol thus recovered varies from one and one-half to four gallons per ton of coal coked. It is clear that the supply of benzol is limited. Its cost per gallon ranges from thirty to thirty-four cents, depending on the cost of coal.

A comparison with gasoline is of value, if this water-white distillate is to be intelligently used as a motor fuel. The heating value per gallon of benzol is slightly more than that of gasoline. It freezes at 41°F. as compared to —50°F. for gasoline. It starts to boil at about 170°F., while the average gasoline boils at 102°F. This means that it will not facilitate starting. Furthermore, the boiling point is fixed within rather narrow limits, while gasoline may have a range from 68°F. to 522°F. Benzol is entirely evaporated at about 275°F. as compared to a gasoline average value of 430°F. This characteristic tends to decrease carbon deposit and crank case dilution after the motor is warmed up. There is very little difference in air requirements, hence no radical carburetor adjustment is necessary.

Pure Benzol a Good Fuel

The ignition temperature of benzol is higher than that of gasoline and it does not have the rapidity of explosive force that gasoline has. These two features make benzol valuable as a motor fuel. The first characteristic tends to decrease pre-ignition from carbon, the second to minimize detonation and the resultant cylinder wall vibration commonly called "pinking." The temperature of explosion is higher, which results in good expansion of the gases.

Benzol is one of the elements of varnish remover and therefore has an injurious effect on the shellac on a cork float in a carburetor. There have been rumors circulated that it pits the cylinder walls, valves and pistons. This may have been the case two or three years ago, but proper present day refinery methods remove all sulphur.

Because of the inherently high boiling and freezing points it is obvious that benzol cannot be used satisfactorily in the pure state. It is therefore mixed in varying proportions, depending upon the weather and use. A specific gravity determination in November indicates that the benzol-gasoline mixtures marketed at filling stations contained about 11 per cent benzol. The suppression of detonation is not noticeable until greater than 20 per cent is used.

Commercial Product 11% Mixture

A laboratory test is being run on different percentages of benzol starting with gasoline, then on 11 per cent benzol, 20 per cent benzol, 30 per cent benzol, etc. The test verifies practically all the statements above made. *The 11 per cent mixture shows no superiority to clear gasoline; in fact, it delivers less power and uses more fuel per B.H.P. hour.* The 20 per cent mixture gives slightly more horsepower but also uses more fuel per B.H.P. hour. The engine ran more smoothly and quietly and without knocking at high speeds on both the 20 per cent and the 30 per cent mixtures than it did with gasoline. The carbon deposit was slightly less in these cases than with clear gasoline.

The advantages of an 11 per cent mixture are negligible. Apparently the 20 or 30 per cent mixtures will decrease carbon deposit and crank case dilution slightly and will give a smoother running engine, especially at high speeds, at a somewhat increased fuel cost, with possibly more starting effort.

THE CORROSION OF IRON AND STEEL

Metallic and Gaseous Impurities Are the Cause of Rusting—Ancient Examples Cited

By J. D. Frazer

SCIENCE is becoming more and more a vital factor in progress. It delves into the reason for a certain condition, and if that condition is an unsatisfactory one it sets for itself the task of devising ways and means of circumventing the causes leading up to that particular condition.

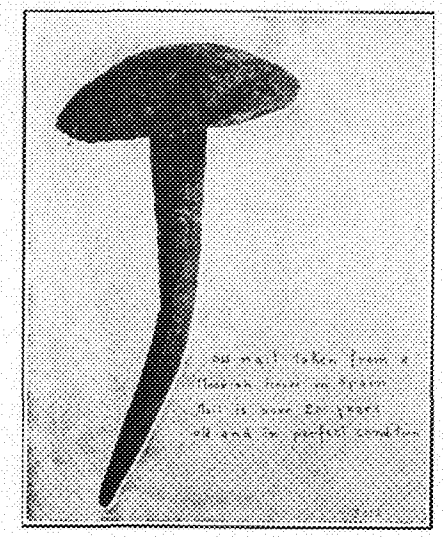
It is estimated that approximately one-seventh of all the steel in use in the world today rusts out every year. It will appear from this statement that the subject of corrosion is one of vital importance, and naturally has commanded the attention of scientists for a number of years. The investigation of corrosion was initiated by a report from the Department of Agriculture. This department, as a result of complaints which were filed by farmers throughout the country upon the service they were obtaining from steel nails and fence-wire, made the assertion that modern galvanized or black steel rusted rapidly because of its content of impurities. The first step in the investigation was to determine why steel rusts, and in a consideration of this subject it would be best to first discuss this question.

IRON BAND TAKEN FROM A CANNON CAPTURED FROM THE BRITISH IN THE BATTLE OF TICONDEROGA, 1775-1777
TEST NO. 1036 FILE 81

ANALYSIS

Sulphur	.005
Phosphorus	.069
Carbon	.010
Manganese	.010
Copper	.080
Silicon	Trace
Oxygen	.053

If a black iron nail is driven into galvanized siding which is exposed to the weather, it will be found that the zinc in the galvanizing will have a tendency to plate itself over the exposed portion of the nail which is in contact with the sheet. Consulting the list of electric potentials, we find that zinc is electro-positive to iron, and it is reasonable, therefore, to draw the deduction that by an electrolytic action the zinc sacrifices itself to the iron to protect it. Now, when we turn to a consideration of the positions of the Big Five, which are the impurities ordinarily found in combination with iron in the production of steel, we find that all of them with the exception of manganese are electro-negative to iron, and it is natural to expect that in the presence of an electrolyte the iron in turn would sacrifice itself to the four impurities which are electro-negative to it, viz., silicon, sulphur, phosphorus and carbon. We have, as it were, in a piece of steel thousands of minute batteries, with iron as one pole and the four impurities named as the other pole. Most atmospheres contain sulphur in varying quantities due to the presence of smoke. This sulphur combined with oxygen forms sulphates, which dissolved in atmospheric moisture form dilute solutions of sulphuric acid, and these solutions, when brought in contact with the two poles of the battery we have referred to, set up a current in which the iron is destroyed.



Impurities Will Segregate

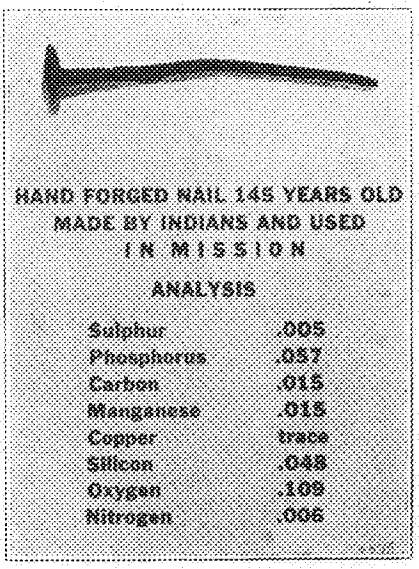
This electrolytic theory of corrosion not only explains the phenomenon of rust itself, but also explains the character of rust. When the impurity content in a steel reaches a certain point the impurities have a strong tendency to segregate in nodules. The pitting rust which is characteristic of the corrosion of modern steel indicates that where the pits are the more prominent, nodules of these impurities originally existed. On the other hand, where the impurity content had been reduced, the impurities have a tendency to distribute themselves homogeneously throughout the body of the metal, so that the corrosion that does take place is uniform, and the pitting action of rust is not so evident. While the old cut nails our fathers at one time used would resist corrosion many times as long as the modern galvanized nail, a thin film of rust did form upon it, but the rust action was not nearly as disastrous because pitting did not occur.

In the case of manganese, the remaining member of the Big Five, we find that while it is electro-positive to iron it does have a tendency to oxidize rapidly, and its oxidation proves as disastrous to steel as the oxidation of the iron itself. In modern steel also we find the presence of copper in a greater or less degree, and there are those who claim that the addition of copper to ordinary steel has a tendency to retard corrosion. It would seem, however, that such a contention is fallacious, because copper is strongly electro-negative to iron, and if the electrolytic theory of corrosion be accepted, it must be admitted that copper will take its place with silicon, sulphur, phosphorus and carbon in accelerating corrosion. The following simple experiment establishes this contention quite strongly: If two clean pieces of commercial iron and steel 2" square are taken, and one plugged with a disc of copper and the other with a disc of zinc, and these two samples are placed in

two glasses of water, it will be seen in a few hours' time that the water in the glass containing the copper-plugged sample will take on a muddy color and rust will be seen forming on the steel. On the other hand, the zinc-plugged sample will indicate no such phenomena. In the one case the zinc is sacrificing itself to the steel. In the other case the iron is sacrificing itself to the copper.

Gaseous Content Important

There is another factor which metallurgists are accepting as a vital one in the subject of corrosion, and that is the gaseous content of a metal. All modern steel contains hydrogen, nitrogen and oxygen in varying quantities. These gases exist in occluded and combined form, and are introduced into the process of manufacture by the modern open hearth. In the combined form they produce injurious combinations with the Big Five. In the occluded form they affect seriously the physical structure of the metal itself, producing tiny blowholes either on the surface or in the body of the metal itself. When the shell about them is destroyed by rust, minute cavities are exposed which provide a working place for corrosive influences. Accordingly this subject of gaseous content, which until a few years ago was almost impossible of determination, is now engaging the time, thought and attention of careful commercial iron manufacturers.



HAND FORGED NAIL 145 YEARS OLD
MADE BY INDIANS AND USED
IN MISSION

ANALYSIS

Sulphur	.005
Phosphorus	.057
Carbon	.015
Manganese	.015
Copper	trace
Silicon	.048
Oxygen	.109
Nitrogen	.006

Some very interesting facts bearing upon this important problem are evidenced by a study of iron articles of ancient and semi-modern manufacture. At Delhi, India, the superstitious Hindoos erected an iron pillar as a shrine more than sixteen hundred years ago. This pillar stands today as one of the first evidences of the manufacture of iron, and it is still practically in the same condition as the day it was set up, in spite of the fact that it has been exposed to abnormally severe corrosive conditions for this long period of time. Sir Robert Hadfield, the prominent English metallurgist, recently obtained samples from this pillar and analyzed them, with the following results:

Silicon	.046%
Sulphur	.006%
Phosphorus	.114%
Carbon	.080%
Manganese	nil
Copper, etc.	.034%
Iron, by difference	99.720%
	100.00%

This analysis portrays a number of very interesting facts which are quite in keeping with the modern theory of the causes of corrosion. In the first place, it will be observed that the content of the Big Five is remarkably low. Manganese, which is one of the chief offenders in causing corrosion, is absent. Sulphur, which all agree is a disastrous element to find incorporated with iron, is extremely low. While apparently no gaseous determination was made, it in all probability was very low for the following reason: the majority of gases ordinarily exist in the occluded form and are removed by continued and careful working of the metal. It is thought that this pillar was not made in one piece, but in sections which were worked and reworked in being welded together, and in this process the gaseous content was almost entirely eliminated in so far as the occluded gases are concerned.

Ancient Examples

The reader will also observe photographs of the nail taken from a Moorish Palace in Spain. After centuries of service this nail is still in a remarkable state of preservation. A photograph is also shown of a nail taken from an old Indian Mission, and an iron band which was used on a cannon employed at the Battle of Ticonderoga. In the case of the latter two, analyses are given which are quite in line with the analysis of the old iron pillar. The analysis of the Moorish nail is practically identical. These illustrations of articles which have actually withstood the ravages of time would appear to substantiate the contention, first, that the electrolytic theory of corrosion is fundamentally correct, and second, that if we desire to eliminate the tremendous loss from corrosion which we are now experiencing, it will be necessary that the refining process in the manufacture of commercial iron be carried on to a point where the impurity content will be practically eliminated; and further, that care must be exercised to work the resulting product to insure the reduction of the gaseous content. While modern open hearth practice and the use of certain degasifiers will accomplish a partial elimination of the gases, the final elimination or reduction must come from the heat treatment after the ingots are poured.

For a time it was felt that galvanizing provided a panacea for corrosion, but actual service has disproven this theory. Galvanizing is merely a temporary preservative like the coat of paint to a house. While a house may be repainted, it is unfortunate that finished products made from galvanized steel cannot be regalvanized, and we must return to the purity characteristic of the irons of ancient and semi-modern manufacture to find a cure for the great curse of corrosion.

The Cornell Society of Engineers has an employment service for placing graduates in good positions, according to the qualifications and desires of the individual.

The Society for the Promotion of Engineering Education accepted the invitation conveyed to the annual convention at the University of Illinois last June and will hold its convention next June at Cornell just after Commencement. More practicing engineers should be members of this organization for the advancement of engineering teaching and those interested may send to Dean F. L. Bishop, University of Pittsburgh, for application blanks.

ALUMNI NEWS

ALUMNI EMPLOYMENT COMMITTEE

The alumni of the College of Engineering and Architecture and the prospective graduates in our Senior class will be much interested in a development which has taken place within the last few months, i. e., the appointment of an Alumni Employment Committee. This committee, consisting of Professors Cutler, Mann, Martenis and Springer, was appointed by Dean Leland on September 28th to act as a court of contact between employers and those seeking employment, to whom the alumni and the former students might come and be put in touch with such vacancies existing in the commercial world of which the College is informed from time to time.

This is not a new thing because the various departments have for many years past acted in behalf of the alumni and more particularly for the benefit of our newer graduates in getting them located in suitable positions, but the present arrangement is broader and better equipped for service than the past method.

The character of the communication sent out from the Dean's office can best be shown by copying from that letter the following essential paragraphs:

"I have undertaken to obtain complete records of the experience of our alumni. One object of this is the publication of these records in a bulletin. The other is to provide an Alumni Employment Service which will enable us to place our graduates in suitable positions, or better positions, where their qualifications will be of the greatest use or value, and to render a service to employers by placing them in touch with the men they desire.

"In order to be accessible to us all, the files of this work will be kept in my office. They will consist of:

"(a) A letter file of the records of alumni and correspondence with them, alphabetically arranged.

"(b) A card file of addresses of alumni, alphabetically arranged.

"(c) A card file of names of alumni by classes (years of graduation).

"(d) A card file of alumni who are available for employment, arranged by class of position.

"(e) A card file of employers.

"Aside from the usual process of placing men at the end of their senior year, with which we shall not interfere except to assist, if possible, it will be advisable to conform to the following procedure in reply to an inquiry from an employer for one or more men:

"(1) Reply to the employer giving names of men who have been advised of the vacancies.

"(2) Notify suitable candidates of the vacancies and advise them to write to the employer if they are interested and to reply to us as to the action taken in the matter.

"It is especially important that we seek the particular qualifications desired by the employer, even though our man is not out of employment. This is the strongest feature of our plan.

"I am glad to inform you at the outset that I have received many letters commending the plan and offering co-operation. Let us endeavor to make it a success. We owe it to our alumni."

The effect already produced by the Alumni Employment Committee is most gratifying and I am quite sure that the alumni who have desired to change their positions or to obtain positions have found it to their advantage to get in contact with the positions which are at present available.

Aside from the fact that the Committee is always glad to be of service in work of this kind, the alumni should feel that their past contacts with the various members of our Engineering faculty will permit them to use these faculty men as references where it may be required for the securing of a position. It is hoped that the potentialities of this committee may be fully appreciated by the alumni and to be assured that at any and all times the faculty of the College of Engineering have their interests at heart and will gladly exert themselves to help out the alumni in their endeavors to better themselves in their chosen profession.

Francis C. Shenehon, C. E. '95, a consulting engineer and dean of the College of Engineering of the University of Minnesota from 1909 to 1917, has been named vice-president and general manager of the Byllesby Engineering and Management Corporation of Chicago. Mr. Shenehon's new position will place him in charge of all construction work for the various Byllesby interests, including the new $80,000,000 project by the Northern States Power Company.

The announcement was made by Col. H. M. Byllesby of Chicago through Robert F. Pack of Minneapolis, vice-president and general manager of the Northern States Power Company. Mr. Pack said that Mr. Shenehon will begin his new duties immediately. He will move to Chicago, where his headquarters will be maintained.

"Both the Byllesby Engineering and Management Corporation and the Northern States Power Company are pleased to announce supervision of all construction work by Mr. Shenehon," Mr. Pack said. "He is one of the best known engineers in the country and it is gratifying to note that a Minnesota man will supervise a great Northwest construction program."

H. B. Palmer, C. E. '22, was home this Christmas on a ten day leave of absence from his work in east central Wisconsin. For the past year he has been doing United States Government work on the Fox River Improvement Project. He is working under Earl Nisen, the District Engineer, who was a classmate of Professor Zelzer at [illegible]

G. G. Cerney, M. E. '20, has an interesting message from the Far East:

"If I were a journalist I would take pleasure in reciting some of my experiences in India, together with some of the interesting political movements which took place here last year in an effort, on the part of the natives, to wrest from the British the rule of their own empire. However, my story would be very similar to that written by Mr. Fred L. Gray, of the Fred L. Gray Company, of Minneapolis, in his little book called, 'Zig-Zagging Through the Orient.' I find that most people, who are not familiar with the Orient, usually first ask about the weather and the heat of India—another question which has fittingly been answered by Mark Twain in his 'Innocents Abroad,' where he says that 'the only difference between winter and summer in India is that during the summer the door knobs melt, and in the winter they just get mushy.' During my stay in India thus far I have traveled over 20,000 miles on those beastly Indian trains, traveled on business mind you, and I have occasionally endured, without undue discomforts, temperatures of 120 degrees in the shade—but it was not always necessary to stay in the shade. The East, of course, has its fascinations and what is known as the 'Call of the East,' yet I cannot say that I like the East (at least India) in any respect. It is, however, the experience of thousands who have lived here, and then left for home, with the intention of staying there, that after they have been at home for a few months they wanted to come back—and did, and they're here yet.

"Mr. H. R. Shellenberger (C. E. '20) and I joined the Standard Oil Company in June, 1920, and shortly thereafter started for India. We separated in Hong Kong but met again about a year ago. He is now stationed in Bombay also. We shall be back in the States next summer for a few months' vacation and hope to meet many of our U. of M. acquaintances while in Minneapolis."

Jim Werdenhoff, C. E. '20, from the wilds of central Mexico has written about some of his experiences:

"During the last six months I have been doing nothing but surveying work; all of it with plane table or transit and stadia on pipe line preliminaries. I finished a seventy kilometer run several weeks ago and just now am doing a little stretch of thirty kilometers.

"We have some pretty fair jungle growth right here and it takes a long time to cut through from one station to the next most suitable one ahead and I often have to sit down and wait for the machete men to go through. This gives me lots of time to ruminate and I have often pictured you (Prof. Zelner) in a similar setting and wondered just how you would have handled this, that, and the other thing, as they arise.

"I am doing my own instrument work, the company not having any instrument men of sufficient accuracy to suit me available, and I also do the topography and the directing of the course. In addition to this I have to see to it that my men behave in camp, take care of my own commissary, and help my foreman take care of his, keep the time, and pay off the men. As I read this over it sounds a little exaggerated, as my foreman really helps me a good deal, but nevertheless I am responsible as I am the only white man in camp, and I have about thirty natives at present.

"Our camping problems are more complicated than up in God's country, as we have to maintain two entirely separate camps, one for whites and the other for the natives. The natives have a woman cooking for them and I have a Chinaman, who does all my dogrobbing in addition to cooking. We have to transport by mulepack and human back, and I change camp every 4 or 5 days, so you can realize that there is lots of time lost in moving.

"We have some old ruins in this part of the country; ruins of an ancient people. I have been mildly interested in them, and have visited several specimens. I have run across and tried to investigate many ruins that are not known to science and that have not been seen by whites before, but they are very disintegrated and so I haven't been able to see much. The Palenque ruins are practically the only ones known generally, and they have been visited by so many people since the time of the Conquistadores that no relics of a portable size remain. I imagine the greater part of these buildings were put up from 1,500 to 2,000 years ago, judging solely from the corrosion of the various limestones used in construction. As picture taking is very difficult due to spoiling of the films before they can be developed, I have very few good pictures of these ruins and they are mighty precious to me, so I can't send you any now, but I'll drop in and see you some day and we'll look them over."

Ed. Loye, Arch. '20, for the past month has been teaching a night class in architecture in the place of Professor Arnal.

Ralph W. Hammett, Arch, '19, is reaping new laurels at Harvard. In the recent Boston Architectural Society Competition his work was placed first in the Harvard group. Here, as elsewhere, Minnesota is being well represented.

Louise France (Mrs. H. S. Quigley), Arch. '21, now resident in Peking, China, has a baby girl. Mrs. Quigley for a time last school year was employed as a teacher in the University of Peking. This was contrary to the rules, as her husband was also a teacher, and both of a married couple are not supposed to be on the staff; but teachers were so scarce that the administration asked Mrs. Quigley to teach, in spite of the rule.

A. D. White, C. E. '22, until November 1 was with the United States Lake Survey, doing hydrographic work on the S. S. Search, out of Manistique, Mich. He is now in Detroit, engaged in steel and concrete construction work.

E. C. Erickson, C. E. '22, has been working on the same construction as Palmer, but has been doing office work, designing for the Project.

Harry M. Sushansky, C. E. '19, finished his work in the oil fields of Mexico recently and returned to New York, where he was considering going to the Orient on road paving work, when last heard from. Sushan was known as Harry Sushansky when he was here, but on his last visit home had his name changed to Sushan. His last address was Aero Club of America, 11 East 38th Street, New York City.

A. A. Rogers, M. E. '..., a member of the firm of Williams & Rogers, Engineers, of Edmonton, Alberta, Canada, is in charge of oil drilling operations in the Peace River district, north of Edmonton.

MINNESOTA GRADS RUN TWIN CITIES

All Important Municipal Engineering Posts Are Held by Minnesota Men

By Chas. M. Burrill

"A PROPHET is not without honor, save in his own country." But Minnesota engineers are honored at home as well as abroad,—witness the recent appointment of Geo. M. Shepard, '09, as chief engineer for the city of St. Paul. With this appointment, Minnesota alumni assume almost complete control of the municipal engineering activities of the Twin Cities. In St. Paul we have Geo. M. Shepard, '09, the chief engineer, and James E. Carroll, ex'91, assistant engineer and superintendent of construction. In Minneapolis we have N. W. Elsberg, '09, city engineer; A. C. Godward, '10, city planning engineer; Fred T. Paul, '09, engineer in charge of construction of the Franklin Avenue bridge; John Arthur Jenson, '05, superintendent of the waterworks; C. E. Doell, '16, engineer for the Park Board; and J. C. Vincent, '03, mechanical and electrical engineer. Besides these here enumerated, there are many others in less prominent positions.

Prominent in College

George M. Shepard obtained his preparatory course at Shattuck and graduated in civil engineering at the University of Minnesota in 1909. He was a member of Theta Tau, Tau Beta Pi, and Sigma Xi fraternities, and was very prominent in University activities. He was editor-in-chief of the Minnesota Engineer, the predecessor of the Techno-Log, and was secretary of the Engineers' Society. Outside the College of Engineering, he served on the Senior Prom Committee, and was a member of Grey Friars.

Following his graduation, Mr. Shepard was engaged for a number of years in railroad work, first in bridge design with the C., M. & St. P. R. R. at Chicago, and then in Montana with the location department of the Great Northern. Following this he was transferred to the St. Paul office as junior engineer on the Upper Mississippi work, where he remained until 1912. During the next two years he obtained his first experience in municipal work as city engineer of Jamestown, N. D., leaving to assist Adolph Meyer in his investigation of Lake of the Woods and Rainy Lake for the United States Government. He was a captain with the Third United States Engineers during the war, and was stationed in the Philippines, and then in the Hawaiian Islands, where he remained until 1919. From that time until his appointment as chief engineer for the city of St. Paul, he has been engaged in private practice as an associate of L. P. Wolfe. He is a member of the A. S. C. E. and of the St. Paul Civil Engineers' Society.

Elsberg Could "Roll 'Em"

N. William Elsberg entered the College of Engineering from South High School, before the days of St. Patrick's celebrations and Civil summer camps. He was vice-president of the class in his junior year, and was a member of the Enigneers' Society, which then flourished as a forerunner of the A. E. S. The '09 Gopher gives with his picture the statement, "Noted for his ability to roll the dice." This goes to show what an all-'round student he was, for he was also a member of Tau Beta Pi.

Upon graduating in civil engineering in '09, he left for the iron range, where he was with the Duluth, Messabe and Northern for two years in location work. In 1911 he returned to Minneapolis to work with the water and sewer departments. He was in charge of the construction of the now completed Third Avenue bridge from 1914 until the war, during which he was in the Enginers Corps of the Navy, stationed at Norfolk, Va. Upon his return in 1919 he was placed in charge of the Franklin Avenue bridge, which position he held until his appointment as city engineer a little more than a year ago.

Geo. W. Shepard, '09.

Mr. Elsberg is very interested in student affairs, and he suggests for consideration the possibility of some arrangement whereby the engineering students might be put to work on the University building program, thus gaining real experience, and, with proper supervision, also save money for the state. He believes that no opportunity for practical work during student days should be overlooked, and questions whether the courses offered do not neglect the practical too much. He does not care for railroad work, and thinks that one summer as chain or rodman on a railroad gang is quite enough. However these things may be, he is sure that the technical graduate has "every advantage in the world" over others in the engineering field.

Paul a "Bear" at Math.

Fred T. Paul, "Pompadour Paul" as they called him at Central High School of Minneapolis, was also a member of the class of '09. He was Civil Editor on the Minnesota Engineer, and agreed fully with the writer on the difficulty of obtaining copy during vacation. He was a member of Tau Beta Pi, and was an active supporter of the Engineers' Society. In the contemporary volume of the Gopher he was characterized as "a wonder at mechanics quizzes," yet he is reputed to have said in reply to a query of the professor as to what planets were known to the ancients, "Venus and Jupiter,"—(pause)—"I think the Earth, but I'm not quite sure."

Mr. Paul was superintendent of sewer construction at Two Harbors, Minn., during the summer of 1908, and served as a draftsman with the engineering department of the city of Minneapolis during his senior year. After graduation he remained with the city, where he has been ever since, except during the war, when he was a captain in the U. S. Corps of Engineers, fifteen months in France. He has been engaged in sewer and street work and in paving, and since the appointment of Elsberg as city engineer a little more than a year ago he has been in charge of the construction of the Franklin Avenue bridge. As president of the Engineers' Club of Minneapolis, and as past president of the Minnesota chapter of the A. A. E., Mr. Paul is quite active and prominent in professional affairs.

Although few would care to even try it, and fewer yet would "get by" with it, A. C. Godward worked full time with the Minneapolis School and Park Boards, at the same time carrying full school work during his junior and senior years, and was successful in both. From the beginning he was interested in engineering, and he had already obtained considerable experience with railroad surveying crews when he entered the University with the class of '09. During his course he was employed by the Minneapolis Board of Park Commissioners, and so the editors of the Gopher seized their opportunity and handed him the "bouquet," "He has been with the Park Board for two years, and so knows all the 'bench marks' in Minnehaha Park." So we see that even at this time engineering was applied to "river-banking,"—but how could Mr. Godward find time for all this?

Is City's First Planning Engineer

Mr. Godward did not return to school in 1907 but remained at Ironton, Mich., with the General Electric Co., in waterpower development on the Montreal River, so did not graduate until '10. On his return to Minneapolis he worked for the School Board as their chief engineer from 1910-22, and when in the past year the position of City Planning Engineer was created, he was given the first appointment. In addition to this he does consulting work for most of the other city engineering departments. In 1918 he instructed the S. A. T. C. Engineers in field work. Mr. Godward is a member of the A. A. E., and is vice-president of the Minnesota Federation of Engineering Societies.

"The class of '09 was a mighty fine class," said Mr. Elsberg, and not without justification, for we note with interest that all four of the men just discussed were classmates. They did not have all the advantages we enjoy by any means, but they would have us believe that the engineering student of those days was made of sterner stuff. In place of a St. Patrick's Day, with its green tea, they took an arbitrary vacation and formed a wild procession to Seven Corners, there to imbibe more masculine refreshment. Instead of the pleasures of a Civil summer camp, they were given the thankless job of relocating the M. & St. L. R. R., of which the company was so ungracious as to take no notice whatsoever. Mr. Shepard, Mr. Elsberg and Mr. Paul were all three charter members of the Minnesota chapter of Tau Beta Pi, and it was largely through their efforts that the Minnesota Engineer was changed from an annual to a quarterly publication.

James E. Carroll was a member of the class of '91, but failed to complete one term. He engaged in miscellaneous surveying work until 1893, when he entered the bridge department of the city engineer's office, Minneapolis. He became assistant city engineer in 1896, leaving in 1903 to become city engineer of Crookston, Minn., where he remained until 1912. Since that time he has been with the

N. William Elsberg, '09.

city of St. Paul, as assistant commissioner of public works until 1916, and then as assistant city engineer, and superintendent of construction.

Carroll a Major

During the war Mr. Carroll was a major in the U. S. Corps of Engineers, in France for a year. He is a member of Delta Upsilon fraternity, the A. S. C. E., the A. A. E., and the St. Paul Civil Engineers' Society.

J. C. Vincent graduated in electrical engineering in 1903. While still in school he was a draftsman for the Twin City Rapid Transit Co., and later became their assistant engineer, leaving last year to become electrical and mechanical engineer for the city of Minneapolis. He is a member of Sigma Xi and of the A. I. E. E.

(Continued on page 36)

SPORTS

FOOTBALL MANAGER

Engineers gained another triumph when Alfred B. Greene, Junior Electrical, was appointed football manager for 1923. He has the honor of being the first student football manager under the new plan. The competition for this position has been very keen throughout the past football season, and the contestants were given all sorts of jobs to do. A committee, consisting of Director Luehring, Coach Bill Spaulding, and Coach Metcalf made the final choice and based their decision on the comparative character, personality, ability and willingness of the contestants. We wish Greene great success in his work next year and hope that more engineers will try out for these managerships each year. Greene will be awarded the official football "M" and will become a member of the "M" club at the end of his year's service.

VARSITY BASKETBALL

The basketball situation, while not all cleared up, looks brighter than at the time of the Macalester game. Severinson and Pesek are the principal ones whose eligibility is questionable. Sevy has a special exam to pass before he will be clear and some decision in Pesek's case should be reached soon. Doc Cooke has worked the men hard during the vacation. Those on the squad who lived in the Twin Cities, practiced every day and the others reported back at the armory on Thursday, December 28th, to start the final practice before the opening of the conference season. Captain Hulteranz is not expected to be able to play until the first of February on account of his knee, and Doc Cooke has almost given up hope of having Cox at all. The probable team which will start the season will be Severinson and Williams or Olson at forward; Bergsland, center, and Pesek and Ecklund, guards. There are several other good men out who are sure to get into the games, but the above line-up should make Minnesota a much feared opponent in the conference games.

INTRAMURAL BASKETBALL

Although inter-class basketball did not get started before Christmas, Fred Whittemore promises that it will commence the second week in January. The Engineer's team, which will represent our college in the inter-college games, will very probably wear special suits, which will be presented to them by the A. E. S. and the Bookstore. The Bookstore will also furnish suitable trophies to the members of the winning class team.

In addition to his work with the wrestling team, Coach McKusick has organized boxing and wrestling classes. These men are preparing for the boxing and wrestling tournaments which will be held during March. A new mat has been added to the equipment so there will be room for more men, and any wishing to enroll in these classes are urged to do so.

SWIMMING

Minnesota this year has a swimming team for which she should be congratulated. It is a team of veterans, with the four places left vacant by graduation filled with men whose showing in practice has caused Coach Thorpe many happy moments. As usual the team contains a goodly number of Engineers. Captain Murry Lanpher and Hib Hill are the vets, while Hugo Hanft, Cliff Jenkins, H. S. Craig, E. L. Ludvigsen, H. E. Bird, and H. W. Nutting are entering on their first year of big time competition. This galaxy of combined engineering and natatorial talent is filling nearly every vacancy on the team and is even threatening to displace some of the vets of last year's championship combination.

Hanft has been going great guns in practice and appears a sure starter in the dash events. Harold Bird has been displaying rare ability on the diving board, he looks like Thorpe's best bet in the dives. Nutting has been showing good stuff in the plunge for distance. He will have to work hard to fill the places of Atwood and Jordon of last year's team, lost by graduation. Cliff Jenkins performs consistently in the 220, and he appears a sure starter in that event.

Minnesota this year meets the strongest teams in the conference. Many good meets are in prospect. The season opens with a practice meet against the Minneapolis "Y" January 19, and the conference season is cracked two weeks later.

GYMNASTS

Minnesota is out again this year to retain her high place in the Conference in this sport. We have always rated among the first three in the Conference and this year will be no exception. The loss of Captain Ernie Carlson of last year's team, by graduation, will be felt, but his brother, Lawrence, who is captain this year, gives promise of bettering Ernie's work. Coach Watson has been working with his squad of gymnasts since the middle of October and will have them working in their best form when the Conference season opens on February 17, with a dual meet against Iowa in the armory. The other meets are: March 3, Wisconsin at Wisconsin; March 9, Chicago at Minnesota; March 17, Conference Meet at Ohio State; and the annual contest of the Northwest Gymnastic Society some time during April.

The men who will represent Minnesota in these meets are: Captain Lawrence Carlson, Julius Perlt, Magnus Skurdalsvold, Harry Sewell, Leslie Miller, Herbert Weyer, Manly Munson, Herman Miller, and George Murdock. A Freshman squad has also been working regularly and the men who have shown up the best so far are Frank Zemlin and L. W. Neubauer. Engineers who will participate in the meets are Herbert Weyer, Manly Munson and

ENGINEERING AND HONESTY

The newspapers have carried the story of an engineering student who found that he had been credited too highly on his examination papers. He returned the papers to his professor, called attention to the error, and received the lower marking which his work deserved.

To draw a moral of honesty from such an instance would be to lose sight of several things. Engineering is honesty. This student may or may not have acted on a consciously ethical and moral impulse. He may or may not have returned the papers because his stock of religious inhibitions were wholly against his availing himself of an undeserved credit. These matters could only be decided after conference with the student himself. But, in any case, it is precisely what he should have done *as an engineering student*. Engineering *is* honesty. It is the science of the truth of materials and their use. As an engineer this young man would know better than to place a 2,000-pound strain on a 500-pound strength. It is just as fatal to the general concerns of society for anyone to place 100 per cent confidence in what is 50 per cent deception. A whole community was plunged into ruin the other day, years of its time and labor and incalculable values of a more delicate kind were destroyed, because the people placed 100 per cent dependence upon a banker who was only 25 per cent dependable. A course in engineering would have been good for that banker—and maybe for that whole community. All of us ought to know on what we are resting the life of the community and the nation, all of us ought to know whether the institutions on which we depend are strong enough to carry the load.

With more of the engineering type of mind in public affairs there would be more general safety. Engineering is edifying—that's its business. It enters into all building, it is the technique, in one form or another, of The Race of Builders. If our politicians were tinctured a little with the a b c of engineering we should not only have honesty (that goes without saying) but efficiency, the kind of efficiency that knows that national life cannot be built on a foundation of wind-bags, and that a national monetary system cannot be made the cornerstone of private concessions.

This country wants engineering types, not only in every field of industry but in finance and legislation and in public health and in all our economic and educational affairs. Because the engineering type goes to the foundation and builds up honestly, knowing that only honest building will stand.—The Dearborn Independent, Dec. 16, 1922.

TAU BETA PI INITIATES THIRTEEN

On December 13, Tau Beta Pi held their twenty-sixth semi-annual banquet at the West Hotel in honor of the new initiates. Former Dean F. C. Shenehon gave the principal address of the evening. His topic was "The St. Lawrence-Great Lakes Waterway Project." Prof. A. S. Cutler, a charter member of the society, acted as toastmaster. The new members of the fraternity are: Sidney Acker, Mechanical; Carl I. Aslakson, E. Reuben Grant, Orville H. Hosmer, Aubrey C. Leonard, Civils; Harry C. Dinmore, Jr., Sam K. Kwong, Everett H. Tollefson, Mines; Edwin H. Friedman, George J. Schottler, Walton Wellisch, Frank Wilson, Elec-

WANTED—By the Engineering Library, two copies of the Year Book of the Society of Engineers, University of Minnesota, 1901, Vol. 9.

Anyone having a copy of this volume will confer a great favor by sending it to the Techno-Log.

THE ENGINEER

Sung to the tune of "Son of a Gambolier."

Who is the man designs our pumps with judgment, skill and care?
Who is the man who builds 'em and who keeps them in repair?
Who has to shut them down because the valve seats disappear?
The bearing-wearing, gearing-tearing *mechanical engineer.*

Who buys his juice for half a cent and wants to charge a dime?
Who when we've signed a contract can't deliver half the time?
Who thinks a loss of twenty-six per cent is nothing queer?
The volt-inducing, load-reducing *electrical engineer.*

Who is it takes a transit out to find a sewer to tap?
Who then with care extreme locates the junction on the map?
Who is it goes to dig it up and finds it nowhere near?
The mud-bespattered, torn and tattered *civil engineer.*

Who thinks without his products we would all be in the lurch?
Who has a heathen idol which he designates Research?
Who tints the creeks, perfumes the air, and makes the landscape drear?
The stink-evolving, grass-dissolving *chemical engineer.*

Who is the man who'll draw a plan for everything you desire?
From a trans-Atlantic liner to a hairpin made of wire?
With "ifs" and "ands," "howe'ers" and "buts," who makes his meaning clear?
The work-disdaining, fee-retaining *consulting engineer.*

Who builds a road for fifty years that disappears in two
Then changes his identity, so no one's left to sue?
Who covers all the traveled roads with filthy oily smear?
The bump-providing, rough-on-riding *highway engineer.*

Who takes the pleasure out of life and makes existence hell?
Who'll fire a real good-looking one because she can not spell?
Who substitutes a dictaphone for coral-tinted ear?
The penny-chasing, dollar-wasting *efficiency engineer.*
—Bulletin of the Minnesota Federation of Architec-

EDITORIALS

AN ENGINEER ON THE BOARD OF REGENTS

Now that the appointment of Pierce Butler, regent of the University of Minnesota, has been confirmed, the University is faced with much the same situation as confronted President Harding when it was decided that Mr. Butler should be accorded the honor of filling a vacancy on the Supreme Bench. The problem before the administration is to make an appointment to the regency to take Mr. Butler's place.

It seems that in one particular, at least, they would do well to pattern after the President's action on the Supreme Court vacancy. The President, of course, wanted to pick a man who was of the highest calibre, yet he realized that all the good men were not confined to any one section of the country; but that, other things being equal, there could be found men in any section well fitted to hold this high position. Therefore, in accordance with our representative principles of government, he chose a man from a section which had been neglected of late and to which representation was due.

The Board of Regents is also, by its nature, a representative body, guiding, as it does, the destinies of each branch and college of the University. Yet it is a fact that never has an engineer served on this Board. No doubt the appointments to the Board of Regents have never been thought of as a representative proposition, as they should be, for from this standpoint the time is long overdue for the naming of an engineer. There is an abundance of prominent engineers, whom I need not name, graduates of Minnesota, well qualified to fill this position.

We believe that the engineers deserve representation; that there are eligible engineers of regent calibre; that an engineer would be a decided asset to the Board; and, finally, that the golden opportunity is here to make amends for past deficiencies by appointing an engineer to the Board of Regents of the University of Minnesota.

A RESOLUTION

This is the traditional time for the making of resolutions, so let us follow the style and make ours, too. They will doubtless be forgotten in a month or so, and consequently will do no harm. So much for an introduction to a commonplace subject; now we will propose a resolution, different at least, perhaps unique.

We resolve not to say, "I haven't got time"—at least we will reduce the use of this phrase to a minimum.

It is a very useful, perhaps more accurately a much used phrase. So are "the street cars were delayed," "my alarm clock didn't go off," "I forgot," but it does not follow that they are desirable.

To put the thought in the form of an epigram, *the use of this phrase is either a white lie or a confession of weakness.* There are twenty-four hours in every day, for everyone, no more and no less. There is the same amount of the most precious stuff in the world for mastery to use as there is for mediocrity to squander.

"I haven't got time to do it,—I'd like to, but——". One of two things is true,—the person answering in this fashion either ought to do the thing, or he ought to leave it undone.

If he ought to do it, he is confessing his weakness, his incapability in coping with circumstances. He *cannot* do what he ought to do and wants to do. He does not know how to use his time. Let us be masters of our time, for this is the secret of accomplishment. When we are using our time with 100 per cent efficiency we may begin to say we haven't time, we are doing all that is possible. But until then let us ban that phrase, which is but another version of *can't*, that word which should be foreign to an engineer's vocabulary.

If he ought to leave it undone, it is but camouflage to say "I haven't got time." What he really means is that he will not take the time, that he has something else for which he would rather use the time. A mild way of saying, "I don't want to do it," or "I won't do it." A white lie, of value not different from others of its category. Would it not be well for us to avoid its use?

Let us start the new year resolved to *use* all of it, to make the *best* use of *all* of it. Try holding your breath for one minute. It is a long time. There will be 525,949 minutes in the year 1923, during which we can accomplish great things.

Let us *have* time, *take* time, *make* time. Let us be so busy accomplishing that "I haven't got time" will be an expression too petty for use.

VACANCIES

There are several positions on the Techno-Log open to freshmen, sophomores, or juniors. Those interested please apply.

Airplanes are being used to locate and photograph undiscovered lakes in the national forests of Alaska. During the New York-Nome flight made by Army aviators, lakes were frequently sighted which could not be found on the latest and most authentic maps of the territory.

A few days' flight, it is said, will be sufficient to cover the area with a degree of accuracy that would require many years and great expense to accomplish by ordinary methods.

O. T. Rood, of the M. E. class of '22, is experimenting upon an absolute viscometer under the direction of Professor Shoop. Mr. Rood's thesis will be a treatise on "Oils and Viscous

CHEMISTS

CHEMISTS CLUB VISITS GAS PLANT

Some thirty or forty members of the Chemists Club on December 2nd began an inspection trip over the large plant of the Minneapolis Gas Co. Mr. Ray Robinson, Chief Chemist, a graduate of the University of Minnesota, School of Chemistry, 1912, very obligingly gave of his time to make the trip profitable, and painstakingly explained every detail of the process and chemistry of gas manufacture.

Minneapolis uses a carburated water gas. Soft coal is destructively distilled, the gases collected and washed and to them is added water gas made from the coke obtained in the distillation, beside a gaseous product formed by passing light oils over heated brick-work. The latter furnishes the illuminants in the gas.

$SeOCl_2$

Now, what would you think of a compound like that? Why, I suppose that most of you don't even know what "Se" stands for. Well, it stands for the element Selenium, the kid sister of Sulfur in the Periodic Table.

Undoubtedly you are now wondering what the occasion is for discussing this supposedly unimportant and useless element—that is, you are wondering, if you were not one of those present at the lecture given December 4th by Professor Victor Lenher of the University of Wisconsin.

Professor Lenher spoke on that evening under the auspices of the Minnesota Section of the American Chemical Society on the subject: "Selenium and Tellurium, and some of their compounds." The audience was one of the largest to attend any of the lectures given under these auspices, and if those not present had known what they were missing, the Chemistry Auditorium would have had to send out for room.

Selenium and Tellurium, as Professor Lenher pointed out, are at the present time used very little, as few uses for them have been discovered. They have been called "rare elements," yet the supply of each far exceeds the demand. They are plentiful in nature and are produced as waste substances in the refining of several metals, copper and lead in particular.

Professor Lenher has made a special study of these elements, and the experiments he performed and the lecture he made were ample proof that his study has really borne results. His favorite compound has proved to be the one first mentioned—selenium oxychloride—and who wouldn't favor it? Its peculiar properties and reactions would arouse the curiosity of any chemist in the world. Perhaps the most interesting use that has been found for it is in combating carbon in automobile cylinders. When it is mixed with the gasoline, the engine runs smoothly, no carbon is deposited and many miles are added to each gallon of gasoline. But—motorists please notice—the products of combustion have the odor of garlic in the extreme. Its use may become popular in Naples, but for the time being, Americans must dispense with its use.

But Selenium Oxychloride has practical properties also, and the chemist will find many uses for it in the laboratory both as a reagent and as a solvent.

And, best of all, Selenium and Tellurium have many other valuable compounds, and, thanks to the efforts of Professor Lenher, they will soon cease to be rare elements; and who knows but what they may some day eclipse their big sister Sulfur in importance to both the chemist and the whole world?

Yes, we came out of curiosity and were greatly amused by the lecture; yet we all went away thinking not on the entertaining side of the lecture but on its practical side. And next time you had better come, too; you can never truly realize what you missed.

NEW SLOW SETTING CEMENT

A new method for the production of a cement which is claimed to have substantial advantages over the forms of cement now in general use is reported to the Department of Commerce by Consul H. C. Clarbourne at Havre. The new process is stated to have been invented in 1908 by the Societe Anonyme des Chaux et Ciments de Lafarge et du Teil. The product is claimed to be basically aluminous and is obtained by the melting down of a specific mixture of silex, alumina, iron and lime. It is said that after much experimentation the Societe has developed it beyond the experimental stage, and in conjunction with the Societe Electro-Chemie et Electro-Metallurgie has succeeded in the melting of cement by an electric oven process, and that these two companies are at present erecting, in the province of Savany, a factory for the manufacture of cement under the new formula.

It is stated that the cement by the new process hardens very quickly, and that within twenty-four hours it becomes harder than artificial cement within a period of a month. Nevertheless, the fact that it begins to set at the end of two hours and obtains remarkable initial hardness at the end of four or five hours, permits its classification as a slow-setting body. A further advantage is stated to be its immunity from decomposition on contact with sea waters or sulphated waters. Likewise, the new cement, which is known as "ciment fondu" (molten cement), should be especially valuable in reinforced concrete construction, by the reason of its high initial strength, which permits it to be unsheltered quickly from the surrounding supports, and permits the use of smaller forms. According to the report of the process, the inventor and prospective manufacturers claim that it will be very serviceable in the manufacture of blocks of all kinds, more particularly of seacoast work carried on between tides, as well as for interlinking and sealing places between disconnected bits of construction.

ARCHITECTS

DECEMBER DESIGN AWARDS

Two Senior Problems were judged this month. In the first, "An Italian Sgraffitto Facade," four Mentions were awarded: to Theo. Sime, John A. Walquist, W. A. Backstrom, Eddie Holien. In the short problem, "An Exposition of Civic Art," Mentions were awarded W. A. Backstrom and Eunice Nielson.

In the first Interior Decoration Long Problem, "A Ladies' Waiting Room in a Department Store," Marion Petri was awarded Mention. The Interior Decoration short problem dealt with "Pompeiian Details," in which problem credits were received by Carl Matthias Wise, Marion Petri and Florence Knox.

Three Junior problems came up for judgment during December. The Long Problem, "An Auction-sales Building," in which Mentions were received by H. A. Magoon, I. Woodner Silverman, E. W. Hawkins, Wallace Bonsall and Anton Johnson, was followed by a construction problem, wherein working-drawings were made for each of the individual designs. In this short problem Mentions were awarded

The Junior sketch problem, "A Tea-House on a Rocky Ledge," gave unusual opportunity for the play of imagination on the part of the designers. Olaf Fjelde and I. Woodner Silverman received Mentions in this problem; and E. W. Hawkins, though receiving a less award, was complimented by the jury on the excellence of his rendering, and the interest of the scheme.

As to the Sophomore designs, a Long Problem—"A Terminal Pavilion in an Exposition"—and a Short Problem—"A State Historical Society Building"—were judged this month. In the former, Mentions were awarded E. W. Krafft, M. R. Busler, A. E. Rigg, Homer Tatham and R. V. McCann. Some very pleasant renderings appeared among these and other of the solutions to this problem. In the Short Problem, Mentions were awarded Fritz Elfstrum, M. R. Busler, E. W. Krafft and Everett Peterson.

SIGNS OF THE TIME

Ever and anon the architectural wit, very subtle in its qualities, crops out in the form of a new sign on the departmental walls. Many *Monuments Historiques* remain from former years to charm the architectural traveler and to bear witness to the genius of our forerunners; but among the newer effusions there are also examples of rare interest and an almost Romanesque barbaric crudity.

In a particularly noisy portion of that celebrated boiler-factory, the Sophomore drafting-room, appear these words on a neat placard: "Padded Cell 13. Roy Norman, Keeper." This is signed by "Herr Kustard." Perhaps it is the worthy herr who added this enigmatic prayer: "Gott sei dank!" on the upper margin.

In another part of the same room is a guide-post sketch-problem metamorphosed into a lighthouse. A beautiful mermaid simply attired in a brown beaver hat sits among the briny billows well in the foreground, around whom sport swans and other unidentified members of the feathered tribe. This phantasy is entitled "A life on the ocean deep."

As to the Senior drafting-room, it is noteworthy not only because of the presence in it of the Poets' Corner of hallowed memory, and the murals as described in our last issue, but also because of several new *decors* of great distinction.

The opposite wall is adorned with the following announcement:

THE KNOCKABOUT CLUB

We do hereby elect Theo. Mushtachio ——————(this word has been blacked out with borrowed ink, which makes the meaning of the sentence quite conjectural) as the scholarly gentleman and cultivated architect of the Senior Class.

Signed:

and then it is signed by lo! many ossifers, from the Chief Knocker himself down to the Left Knocker himself. The insign of the organization is a shield-tilting, charged grotesques flanked and mallet descending, sable, with stars, or. Crest: arm-and-hammer à la baking-soda, sable. Motto: Knock and it shall not be op'n'd unto you.

Below this tablet, by the way, may be found the Knockabout Club-rooms, consisting of one checker-board, upon which the members hold solemn tournaments, Walnetto vs. Honeyscotch.

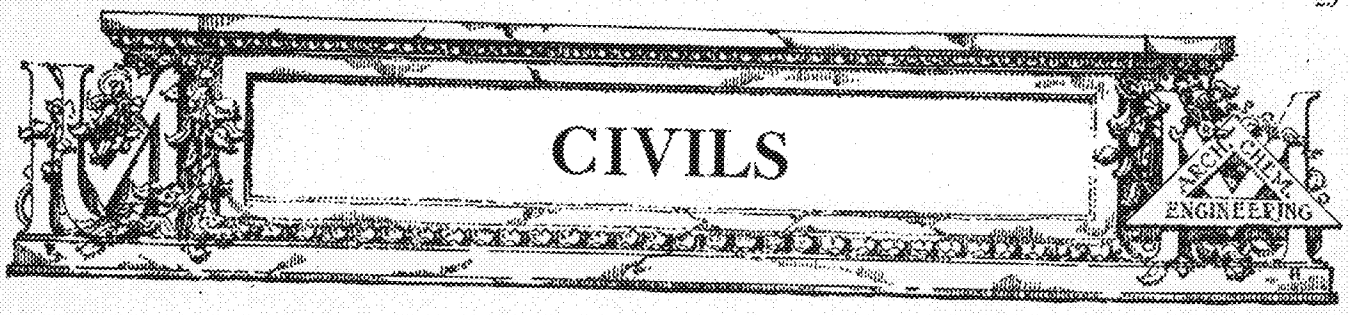
But the most amusing sign of all hangs in the library. It reads:

QUIET
MUST BE MAINTAINED
IN THIS ROOM

NEWS OF THE TRAVELERS

A pretty ceremony took place on the evening of December the 15th, when Miss Gladys Brouillard, the architectural office boy, departed for Buffalo, New York, and other Eastern vanishing-points. As she emerged from the office engagingly garbed in a traveling-suit and bag, with hat to match, she was met by a committee with flowers. Refusing all but one blossom of this offering, she found her way carpeted with chrysanthemum petals, leaves and stems. Before arriving at the head of the stairs she was met by a second delegation which presented her with loaf-sugar and a piece of toast (very dry). Excusing herself from acceptance of these viands by a graceful acknowledgment of the number of Herschey-bars she had in her bag, she swept on through the admiring multitude. Holien, the footman, bowed low from the neck up (thus displaying the plume in his hat) as she dropped a small pourboire into his ready palm. And thus farewell!

Unfortunately the Pathé News photographer arrived too late to film this very charming spectacle.



TOUGH SLEDDIN' FOR SIMPLE SENIOR CIVILS

Due, no doubt, to the lack of surface storage of precipitation, the Senior Civils have found the sleighing rather rough and tough. Twelve "cons" and one "T" out of a class of twenty-three were tucked amongst the Yuletide offerings this year. These tokens of remembrance must have been given with the thought that it is better to give than to receive. To one of the number receiving a gift, a "con" means a pass anyway. Which way he will pass is the question. Just the same it is colder in the country than it is in the summer.

Dame Nature has been working overtime out in the vicinity of Rose Hill Nursery. The topographical maps of this year's junior class compared to those of last year's shows the fact so obviously that there remains no doubt. 'Tis indeed strange how the hills and valleys out there change from year to year. Prof. Zelner, who lives out that way, says that the change is brought about so gradually that he doesn't know it is taking place until the fact is brought home to him when he glances over the maps of his Junior Civil class.

A short sophomore meeting was held on Dec. 13, at which plans were laid for giving an all-sophomore dance, and several committees were appointed. Let's all get behind this thing, sophs.

If the work of the student chapter of the A. S. C. E. is to be carried out successfully, the organization must receive a backing of enthusiasm. The juniors and the seniors, being in a position to realize better the importance of the A. S. C. E., have been doing their part, but there has been a decidedly noticeable decline in the attendance of the sophomores at the meetings. Fellows, there is probably no better way of becoming acquainted with worthwhile men and the things which they are accomplishing. These engineers are interested in the same things we are, and their talks will give us much of value which is not obtainable from books.

Prof. J. I. Parcel, A. S. C. E., gave a very interesting talk, illustrated with slides, to the Civil department a few weeks ago. A vivid outline of the evolution of the art of bridge building was given, together with considerable material concerning European bridges which Mr. Parcel studied on his recent trip abroad, and many pictures of world famous bridges were thrown on the screen. The A. S. C. E. secured Prof. Parcel for this lecture and was very much displeased at the small turnout. The ones that stayed away were the losers, but let's show more interest in such things from now on.

THE ELIMINATION OF TRAFFIC HAZARDS

An intimate relationship exists between the elimination of traffic hazards and the efficient design, construction and maintenance of highways. A momentous responsibility rests on Federal, state, county and municipal highway engineers constantly to realize the public duty which is imposed upon them, to safeguard to the maximum extent the life and property of persons using the highways.

Roadways should be constructed of widths that will allow the safe passage of all classes of vehicles. Congestion is resulting on many trunk highways due to the temporary parking of motor vehicles undergoing repairs. This practice at night, especially in the case of a vehicle without a tail light, constitutes a serious source of danger. On narrow roadways, fourteen to seventeen feet in width, the safety of the traveling public may be increased by the marking of a center line on the pavement surface. Where traffic demands a greater width than a two-lane highway, the construction of a four-lane highway thirty-six to forty feet in width is recommended.

Hill crests on highways constitute as serious traffic hazards as sharp curves on level stretches of highways. A center line marked on the pavement over the crest materially reduces this traffic hazard. In the case of railroads crossing highways at grades, a clear sight of the railroad for five hundred feet on each side should be provided, and a clear sight of the railroad for a thousand feet on each side of the highway is desirable. The grade of the highway should be level or not over two feet rise or fall in one hundred feet. The excessive use of loose gravel has been the cause of many accidents.—*The Michigan Technic.*

Nathaniel Mintz, E. E. '22, is with the Cutler-Hammer Co., in Milwaukee.

Roy V. Wright, '98, has been elected one of the managers of the A. S. M. E. He has been chairman of their program committee, and is now managing editor of the Railway Age.

ELECTRICALS

A. I. E. E.

The second meeting of the Minnesota Brauch, on December 6, 1922, began with dinner at the Minnesota Union at 6:00 P. M.

The topic for consideration was the St. Lawrence Waterway Project, and the discussion was opened with an abstract of an article by Hugh L. Cooper of New York entitled "The Improvement of the St. Lawrence From the Viewpoint of Private Capital," published in the A. I. E. E. Journal November, 1922. This abstract, prepared and presented by Frank Wilson '23, served as an excellent introduction to the subject.

Then followed the principal speaker of the evening—Francis C. Shenehon, former dean of the College of Engineering and Architecture. Mr. Shenehon is chairman of the committee appointed by the Minneapolis Civic and Commerce Association to study the matter, and consulting engineer for the Northern States Power Co., and the Niagara Power Co., and so was able to speak both authoritatively and most interestingly. As a personal friend of Mr. Cooper he discussed his article quite intimately.

Points emphasized by him were: (1) The project is primarily a transportation problem—power development comes second. (2) It is not a dream, but is inevitable, for the power to be obtained will more than pay for the improvement, to say nothing of the benefits to shipping. (3) To show the importance of good transportation, it costs more to have a ton of coal carried from the street to the house than from Cleveland to Duluth by water. (4) To show the importance of Great Lakes shipping, if the shipping for one year had to be carried by rail it would cost $700,000,000 more. (5) The power to be obtained from five or six dams with a total head of about 220 feet will be not less than 4,000,000 H. P. (6) Since the project is so large and of such great benefit to the country as a whole, it should be handled by the governments of the United States and Canada (since Canada is equally affected).

Donahue and Mauderfeld, postgraduate students in Electrical Engineering, have been working under the direction of Prof. Springer on tests of insulators. Recently they tested some large glass insulators for the Northern States Power Co. The tests were conducted in the Electrical and under three conditions —dry, rain test, and immersed in oil. The source of voltage for the tests was the 350,000 volt transformer. Work around such voltages is very dangerous and extreme caution must be exercised. In the rain test a very ingenious method was employed to give as real an effect as possible. A pipe was so arranged as to cast a spray of water over the insulators, the excessive water being caught in a canvas. In each test the voltage was raised to a point where it sparked around or punctured the insulator.

Adolph Meyer, noted hydraulic engineer, will address the next meeting of the A. I. E. E. on the subject, "The Power Possibilities of the High Dam." A moving picture of the Keokuk dam will also be shown. Be sure to save the date, Thursday, Jan. 18.

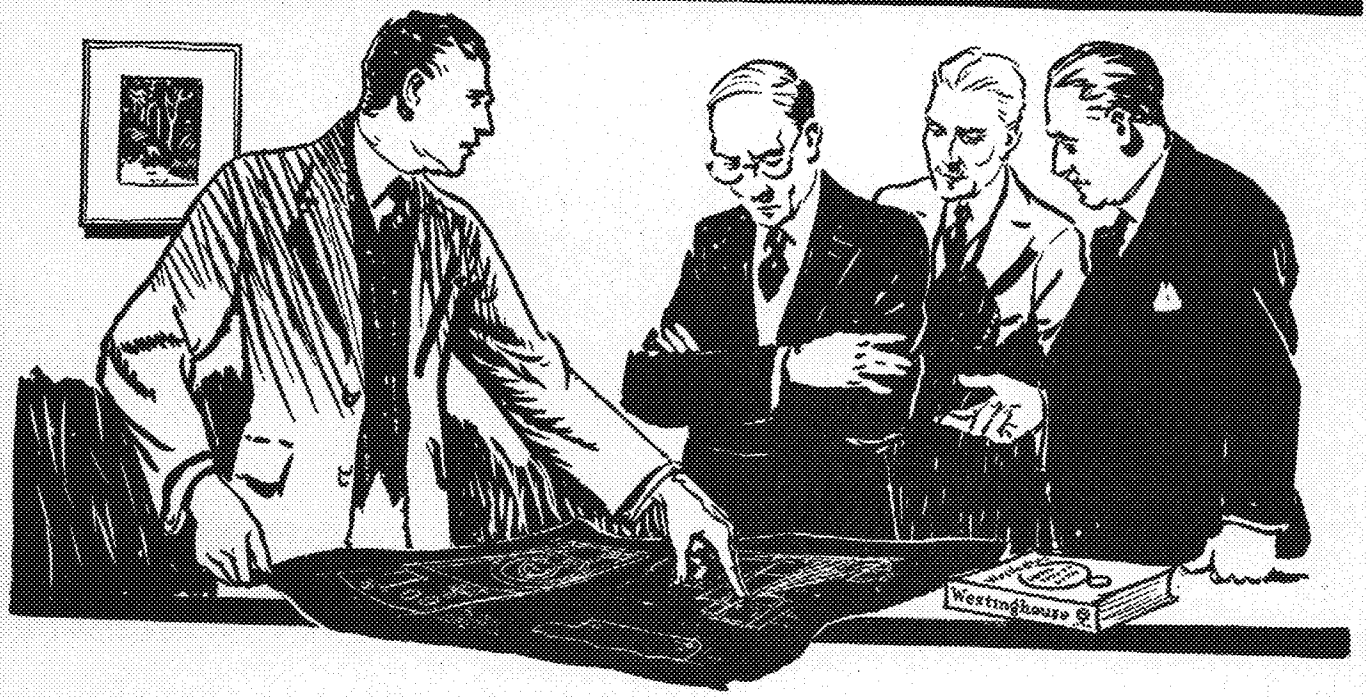
USE OF CARRIER-WAVE TELEPHONY

By L. C. Larson

GRADUATE thesis work involves, primarily, research and study by the student upon some original problem apparently closely related to the work of the department in which his bachelor's degree was obtained. One of the many problems confronting those interested in the research field of radio telephony is that of simplifying the apparatus used therewith at present, at the same time increasing its reliability and efficiency. In connection with the latter point, the question is often raised: "Will radio telephony ever displace our ordinary telephone systems?" The answer to this question will be apparent enough to broadcasting enthusiasts this winter. Based upon what is now known of multiplex, duo-directional, radio telephony, one can hardly predict a universal use of the radio telephone similar to that of the present telephone within the next ten years.

There are, however, certain instances wherein radio telephony may be, and is, applied in a somewhat different sense than we are ordinarily familiar with. The "carrier frequency current system" has been a great aid to long distance (trans-continental) telephony. Much the same apparatus as used to furnish and amplify the electrical energy involved in radio telephony is used upon "carrier frequency" systems. As yet, very little data is available concerning the design of apparatus suitable as a means

(Continued on Page 27)



Engineering Sells, Too!

A whole lot of the make-believe has been eliminated from selling operations in the past ten years. The old idea that salesmen were born to the sample-case, that they carried some sort of a special diploma from the University of Pooh, has had to break camp, along with the other exploded theory which insisted that a salesman must be a "good fellow", a man of strange habits, tremendous stories, and unquestioned qualities both as a mixer, and as an assimilator.

Now we believe—nay, we *know*—that the best salesman is the man who knows most about his goods, and can talk most *interestingly* about them.

This being the proven case, it isn't so queer that engineering should find a real and effective application in the selling field, especially if the merchandise marketed is an engineering product that is bought and operated by engineers.

Every engineer who now engages in the sale and distribution of Westinghouse products feels that he is doing work worthy of his training—for he is carrying Service and Sincerity to Industry, and to mankind! He is out where the fighting is often the fiercest, and he is putting up a battle for the things that he believes are right. And a man can't expect, nor ask, a bigger chance than that!

Sixty percent, approximately, of the engineering graduates who come to Westinghouse find their way eventually into some phase of selling. And we are proud to have them there—and they are glad to be there!

Westinghouse

ACHIEVEMENT & OPPORTUNITY

WESTINGHOUSE ELECTRIC

GRADS RUN TWIN CITIES

(Continued from page 14)

John Arthur Jenson, C. E. '05, was long distance telephone engineer for the Northwestern Telephone Co. of Minneapolis in 1905-06, and then resident engineer for the C., M. & St. P. R. R. until 1907. Since that time he has been with the waterworks department of Minneapolis, since 1914 as superintendent. He is a member of Tau Beta Pi, Sigma Xi, the A. S. C. E., the A. A. E., and the American Waterworks Association.

C. E. Doell is with the Minneapolis Park Board, where he has been since his gradnation in 1916. The Civils have doubtless all seen some of his work, for Prof. O. S. Zelner is wont to show some of his drawings as examples of mapping for his students. And if a fine sketch or plan is found among the publications of the Park Board, it is likely to be Mr. Doell's. The story of the man sighting on Polaris moving his transit back so as to obtain a smaller angle, and so more comfortable observing, is an old one, but Mr. Doell asserts that there was a fellow in his class actually dumb enough to try it. He tells many interesting reminiscences of summer camp.

Doell Gets Feet Wet

One evening two of his friends went by canoe to the far end of the lake to call on two girl friends. When about to return they were so enthralled by the moonlight and absorbed in the leavetaking, that instead of stepping from the dock to their canoe they gave a fine example of a "shoe first dive." Ask the Civils if such things occur now.

Mr. Doell also remembers some fine Engineers' Day celebrations, at one of which President Taft was a guest. At another a part of the company playing the "Bird of Paradise" downtown furnished the entertainment in the afternoon—but they didn't have final examinations to compete with then.

Many other alumni are working for the two cities. Leslie Halliday, '21, and Nathan Harris, '21, are with the Minneapolis Planning Commission; Henry M. Lende, '20, and J. E. Young are with the Park Board; Ed. H. Enger is engineer for the School Board, and Verne F. Curtis, '22, is in the city engineer's office. In St. Paul, H. E. Horrwitz, '20, is with the city planning board, working on the Capitol approach project.

In this connection we note that the three men given the most important posts in the reorganization of his department recently effected by Ramsey County Surveyor Paul N. Coates are all Minnesota men. They are: Ealy G. Briggs, '00, construction engineer; R. J. Wolfangle, designing engineer, and A. R. Thayer, accounting engineer.

'N. P.' BRIDGE

(Continued from page 6)

was especially intense in the excavation for No. 3.

By means of an ingenious sliding form, the contractors saved a considerable amount of lumber, labor and time. A height of 16 feet was covered by the form, the bottom half hard and the upper half newly poured. As each 8-foot section hardened, the form was raised another 8 feet with block and tackle. It was fastened in the middle by 1½-inch bolts to cones, placed in the piers, which in turn were held together by ¾-inch rods through the piers. As the forms were raised, the cones

MECHANICALS

Pi Tau Sigma Initiation

Minnesota Gamma Chapter of Pi Tau Sigma, honorary mechanical engineering fraternity, initiated the following men on December 6, 1922: Seniors, Arthur Gilstad, Arthur W. Sear, and Delton T. Waby; juniors, Joseph A. Anderson, Charles R. Blodgett, Lloyd P. Grobel, and Harley R. Langman.

Initiation ceremonies took place in the Main Engineering Building, in the afternoon. In the evening, a banquet was held at the Curtis Hotel, in honor of the new initiates.

The regular December meeting of the U. of M. Section of the A. S. M. E. scheduled for December 16 was cancelled because of final examinations.

In order that the members of the A. S. M. E. who were unable to attend the Annual Meeting of the Society might hear the principal addresses and discussions on Wednesday, December 6, the Westinghouse Company installed a wire in the Engineering Societies Building, running to the auditorium platform. The speeches were broadcast from WJZ with a wave length of 360 meters.

Tau Beta Pi Elections

To Sidney H. Acker, senior mechanical, goes the honor of being the only mechanical to be elected to Tau Beta Pi this fall. "Sid" is a mathematician of no mean ability, and his engineering work in general justifies his election.

During the past few months we have heard a great deal of comment upon the crowded laboratories and shops in the various departments of the University. Attention is invited to the machine shop in the Department of Mechanical Engineering, where in some places it is impossible for two persons to pass each other. Such a congested condition certainly warrants attention and the provision of more floor space is the only remedy for it.

Arnold Nordenson, E. E. '22, is in the engineering department of the Roberts-Hamilton Co., plumbing contractors, Minneapolis.

Glenn Ransom, E. E. '22, has recently been transferred from the Minneapolis to the Chicago office of the American Telephone and Telegraph Co., and is now doing construction work near Black River Falls, Wisconsin.

USE OF CARRIER-WAVE TELEPHONY

(Continued from Page 24)

of communicating over high voltage lines such as the Taylors Falls power transmission line. From a theoretical standpoint and from experimental knowledge of the subject, one can readily see the advantages involved in the use of "guided waves" or "radio for use over power transmission lines."

The first and foremost advantage is that of reliability. Experiments have shown that should the power line blow down, the line be severed, or even become shorted—due to severe storm conditions or otherwise—"guided wave" telephony will bridge the gap and get through. In most cases, the ordinary telephone line which usually parallels the power line, also blows down in the same storm which affects the power line. This leaves no means of ready communication through which to ascertain the trouble and later direct the necessary repairs. "Wired radio telephony" should in time be perfected to the point where a lineman will carry his "ringing-in box" with him at all times so that he may keep in constant touch with other persons along any point of the line.

More Efficient

The second advantage lies in the fact that a power transmission line will conduct the feeble energy of a radio telephone transmitter much more efficiently than any other medium, as, for instance, the air. Consequently, less costly sources of the energies used in radio telephony would be required if the waves are guided over lines rather than through the air.

Third, such a system will be a more or less secret means of communication between stations on the line. It will be secret to the extent that high frequency energy can be confined to the line.

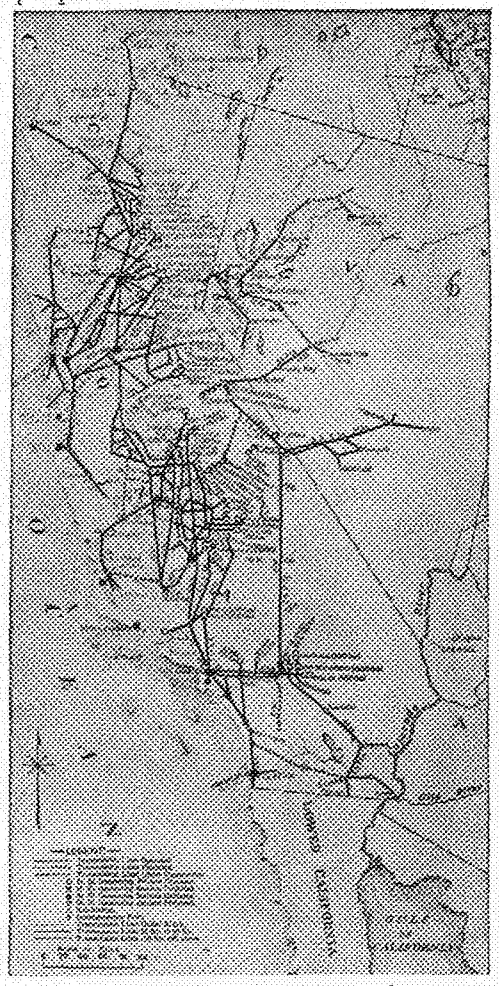
Obviously, the solution of the problem of applying radio telephony to power transmission lines is one which involves telephone engineering practice as well as original research in connection with the inherent characteristics of each individual transmission line. In view of the facilities offered, it is planned to determine and study the characteristics of "dummy" lines made as nearly as possible to compare with the actual lines, then to perform experiments upon actual power lines. This work should lead towards finding the most suitable means of applying the radio frequency energy to the line as well as the optimum frequency for any given line.

NATIONAL ELECTRIFICATION

(Continued from page 7)

and in addition is to have 15 large steam plants, located on the sea coast and navigable rivers. Should these plans be carried out, over 500 small power plants now serving this area will be shut down, and an estimated saving of 50,000 tons of fuel will be made every year.

Nations which are just beginning their electrical development should profit by the experience of the other countries and should, as far as possible, plan their power systems from the very beginning. Power plants should not be permitted to spring up here and there in accordance with immediate demands, for that means local electrification, and the eventual scrapping of inefficient plants at a cost that is passed on to the public. The future needs of the nation as a whole should be considered, and plans laid to utilize existing water powers and to form a network that will give power to the greatest number of people.



Map of California's main power lines

The first step in this direction is to examine all of the nation's rivers, chart the power sites, and study the relative size, economy, and reliability of each source of power. Then a study of the best locations for transmission lines should be undertaken, and this should pay due regard to the development of the water powers in the order of their desirability, the need for steam plants, and the probable requirements of future consumers. With this data in hand it will be possible to lay out a definite plan for a power system that will adequately serve

TECHNICALITIES

HOTEL RULES FOR VISITORS AT YAP'S CROSSING.

Guests are requested not to speak to the dumb waiter.

House is not responsible for diamonds or bicycles left under the pillows; they should be deposited in the safe.

Board, 50 cents per square foot. Meals extra.

Guests wishing to get up before breakfast may have self-rising flour for supper.

Anyone troubled with nightmare will find a halter on the bed-post.

If you're fond of athletics, and like good jumping, lift the mattress and see the bed spring.

Anybody getting thirsty will find a keg of nails in the basement.

If the lamp goes out, take a feather out of the pillow; that's light enough for any room.

EXCERPTS FROM A HOME-EC'S NOTEBOOK.

Preserving and canning season of the almanac is now on. Housewives put up fruit in the summer so they will have something to throw away in the winter.

Strawberry Panic: Take one large marmalade and pick the bones out of it. Invite the neighbors to try it first. It tastes better when taken by mistake in the dark.

Subway Jam: Pick feathers off a box of razzberries. Add anything. Place in the bread-box to cool. If you give the ashman an Xmas present, he will take it off your hands.

Rhubarb Surprise: Beat two quarts carefully, add one teaspoonful, mix up with one pound. Throw in one dozen, first having removed the seeds. If it's any good, that's the surprise.

Antiseptic Pineapples: Add one bushel of oyster shells to nearest ingredient. Whip with eggbeater until it surrenders. Seal in jars without two or three flavors. It is better without flavor, especially vanilla.

Potato Syrup: Boil umbrella cover in porcelain vat. Add a dozen shoe trees. Boil until cool; add something, subtract it. Sew three raisins on it with strong thread. Don't be discouraged if neighbor's dog starts to howl at the moon. That's nothing but superstition.

Onion Jelly: Take two or three olives anywhere. Soak for two weeks, but don't lose pawn ticket. Add quart of beans or their equivalent in cash. Before sampling, cancel all engagements.

Doctor's Delight: Take wagon-load of best fresh evaporated apples. Add demi-tasse of watermelon. Add camphor to keep moths away. Skim off top until you reach the bottom. Skim that off, too. Put up in capsules, and eat in restaurants for rest of year.

PANTS.

Pants are made for men, and not for women. Women are made for men and not for pants. When a man pants for a woman and a woman pants for a man, they are a pair of pants. Such pants don't last. If you want to make the pants last, make the coat first. Pants are like molasses—they are thinner in hot weather and thicker in cold. Men are often mistaken in pants; such mistakes are "breeches" of promise. There has been much discussion on whether or not pants is singular or plural; it seems to us that when men wear pants it is plural, but when they don't wear pants it is singular. When men go on a tear in their pants, it is all right, but when the pants go on a tear it is all wrong.

There was a young lady named Maud,
Who was quite a society fraud;
In the ballroom, I'm told,
She was distant and cold,
But on the back porch—Omigawd.

"Why do they whitewash the inside of a chicken-coop?"

"I'll bite; why do they?"

"To keep the chickens from pecking the grain out of the wood."

A real modest girl is one that will not look at a battleship when it is stripped for action.—Exchange.

BRINGING MORE DAYLIGHT INTO INDUSTRIAL BUILDINGS.

Dr. George M. Price, writing on "The Importance of Light in Factories," in "The Modern Factory," states: "Light is an essential working condition in all industrial establishments, and is also of paramount influence in the preservation of the health of the workers. There is no condition within industrial establishments to which so little attention is given as proper lighting and illumination. Especially is this the case in many of the factories in the United States. A prominent investigator, who had extensive opportunities to make observations of industrial establishments in Europe as well as in America, states: "I have seen so many mills and other works miserably lighted, that bad light is the most conspicuous and general defect of American factory premises."

"My own investigations for the New York State Factory Commission support this view. In these investigations it was found that 36.7% of the laundries inspected, 49.2% of the candy factories, 48.4% of the printing places, 50% of the chemical establishments, were inadequately lighted. There was hardly a trade investigated without finding a large number of inadequately lighted establishments."

Inadequate and defective lighting of industrial buildings is not confined to the establishments in New York State alone. The same conditions prevail in most sections of the country.

Such conditions as mentioned above are entirely opposed to the laws of health, sanitation and efficiency. Wherever poor lighting conditions prevail, there must be a corresponding loss of efficiency and output both in quality and in quantity. American industry is not using nearly enough daylight and sunlight in its buildings. Every endeavor should be made to use as much as possible of daylight for lighting purposes. To obtain this it is of course necessary that the rays of daylight and sunlight are permitted to enter the interior of the buildings as freely as possible, with the important modification that the direct rays of the sun must be properly diffused to prevent glare and eyestrain. A glass especially made for this purpose is known as Factrolite, and is recommended for the windows of industrial plants. Windows should be kept clean if the maximum amount of daylight is to pass through the glass, but the effort will be well repaid by the benefits secured.

In the presence of poor lighting, we cannot expect men to work with the same enthusiasm as when a well lighted working place has been provided. The physical surroundings have a deep effect upon the sentiments of the employes, and where bad working conditions are allowed to prevail, there is invariably a lessening of morale and satisfaction created thereby. Neglecting to utilize what nature has so bounteously provided, daylight, and which is so essential toward industrial efficiency, we have an instance of wastefulness, but now that the importance of good lighting is becoming recognized, undoubtedly more attention will be given by progressive industrial employers to furnishing the means which are essential for their workers to secure and maintain the efficiency, which counts for so much in the success of any industrial concern in this competitive age.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.
220 Fifth Avenue.
St. Louis. New York. Chicago.

'N. P.' BRIDGE

(Continued from page 26)

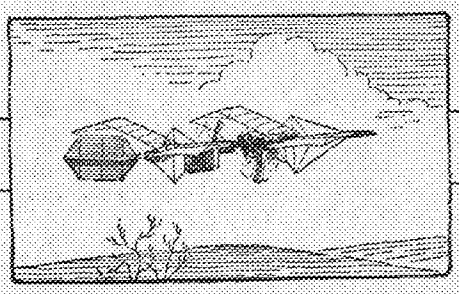
were removed and their holes filled with grout, cement and sand. Tin was at first placed around the cones to facilitate their removal, but tarpaper was found better. These sliding forms were used on all the foundations except the abutments and Pier 2.

Old Spans Used

The old bridge will be torn down, and only the two main spans are to be saved. These will be rebuilt, reinforced with a heavier center truss, and placed in the new bridge. Frankman & Co. of Minneapolis, who will handle all the steel and tear out the old foundations, will not be required to save any other material. The river must, however, be cleaned down to the bed. The remainder of the new bridge will be constructed with plate girders, ranging from 80 to 90 feet in length, and weighing up to 36 tons apiece. The entire structure will contain approximately 800 tons of new steel and 800 tons from the old bridge.

The steel superstructure will be erected on the stationary falsework now being used by two 18-ton dinky engines, with from six to eight cars to a train. Three-quarters of a million feet of lumber are required for each bridge. The west approach will be filled with 100,000 cubic yards of dirt now being removed from the east side right-of-way by a Marion model 60 shovel. Trains will continue to cross the falsework of the old bridge until the new one is completed, and the contract calls for the completion of the whole job early next fall. Mr. M. W. Beach is in charge, with Mr. Walter Bennett superintendent of construction, and Mr. Charles Dolfay general foreman.

LANGLEY'S FIRST



MODEL IN FLIGHT

"The way of an Eagle in the air"

CENTURY after century men broke their necks trying to fly. They had not troubled to discover what Solomon called "the way of an eagle in the air."

In 1891 came Samuel Pierpont Langley, secretary of the Smithsonian Institution. He wanted facts. His first step was to whirl flat surfaces in the air, to measure the air pressures required to sustain these surfaces in motion and to study the swirls and currents of the air itself. Finally, in 1896, he built a small steam-driven model which flew three-quarters of a mile.

With a Congressional appropriation of $50,000 Langley built a large man-carrying machine. Because it was improperly launched, it dropped into the Potomac River. Years later, Glenn Curtiss flew it at Hammondsport, New York.

Congress regarded Langley's attempt not as a scientific experiment but as a sad fiasco and refused to encourage him further. He died a disappointed man.

Langley's scientific study which ultimately gave us the airplane seemed unimportant in 1896. Whole newspaper pages were given up to the sixteen-to-one ratio of silver to gold.

"Sixteen-to-one" is dead politically. Thousands of airplanes cleave the air—airplanes built with the knowledge that Langley acquired.

In this work the Laboratories of the General Electric Company played their part. They aided in developing the "supercharger," whereby an engine may be supplied with the air that it needs for combustion at altitudes of four miles and more. Getting the facts first, the Langley method, made the achievement possible.

What is expedient or important today may be forgotten tomorrow. The spirit of scientific research and its achievements endure.

General Electric

General Office Company *Schenectady, N.Y.*

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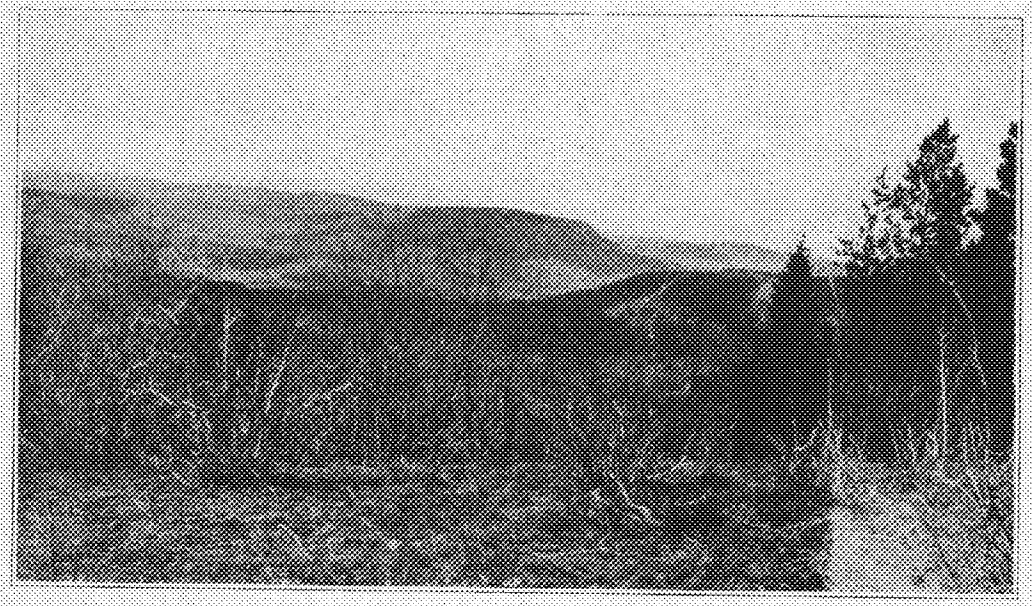
MINNESOTA TECHNO-LOG



FEBRUARY 1923

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VOL. III UNIVERSITY OF MINNESOTA NO. 4

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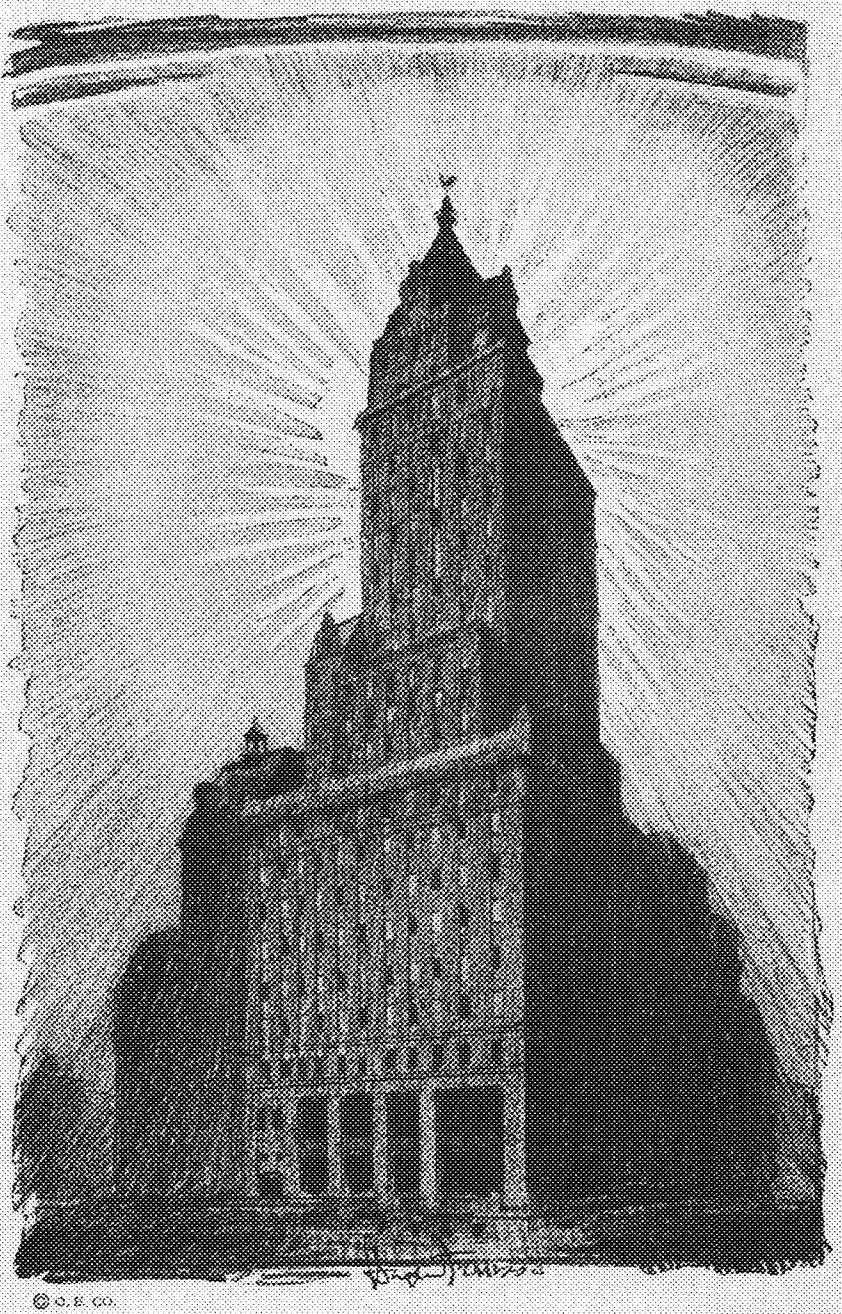

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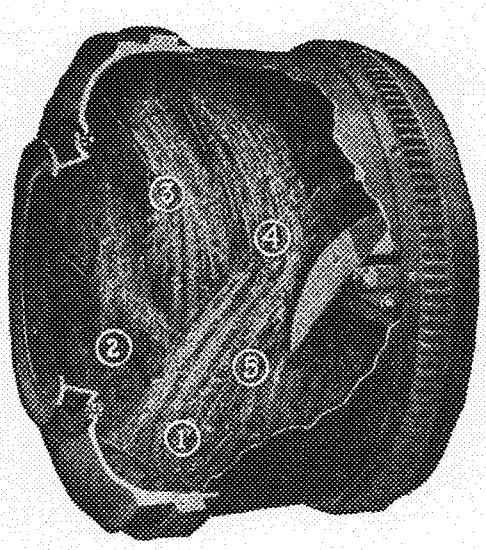
—on what does it depend?



(1) Blade cuts through materials with churning action. (2) Blade carries materials up, spilling down again against motion of drum. (3) Materials hurled across diameter of drum. (4) Materials elevated to drum top and cascaded down to reversed discharge chute which (5) with scattering, spraying action, showers materials back to charging side for repeated trips through mixing process.

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MINNESOTA TECHNO-LOG

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University of Minnesota

VOLUME III FEBRUARY, 1923 NUMBER 4

ST. PAT'S DAY RECOMMENDATIONS

Harold E. Peckham, Chairman of the 1922 Celebration, Offers Suggestions to Engineers

Having completed my duties as chairman of the Engineers' Day committee, and, as I believe, having learned by experience some things which may be of value to the Association, I wish to submit a number of recommendations having to do with future Engineers' Day Celebrations.

Date of Celebration

I would suggest first, as being of greatest importance to the success of future celebrations, that the date of the celebration be changed from March 17 to the third or fourth Friday of April. The wisdom of such a recommendation, I am certain, will be questioned, but I believe that last year's experience at Minnesota and the experience of other engineering schools justifies the change. The three-quarter system has made proper celebration on March 17 a positive hardship. Completion of second quarter work and final examinations interfere greatly with the celebration. Last year final examinations started the third day following March 17. Underclass-men, called upon to do most of the work of the parade and open house, and juniors, under whose direct charge the celebration was held, were seriously handicapped by unusually heavy class work and preparation for final examinations. The schedule for 1922-23 will not differ from that of last year in any material way. Final examinations will work the same hardship again unless some change is made.

There are other considerations. Religious and racial objections have been made to celebration on March 17. Many other engineering colleges have been forced to change the date of celebration. In these other schools where objections have been made, the nature of action taken has indicated that the objection is not provincial, and that we at Minnesota will not be immune long. Unpleasant weather threatened last year to injure the success of the parade, and March weather always has been unsettled. While it is impossible to set a date, and guarantee favorable weather, April gives better promise than March. Snow threatens but seldom in April, and cold weather usually is at an end.

Collegiate Engineers' Convention

This year I received considerable inspiration and many good suggestions for the Engineers' Day celebration while attending the convention of the Association of Collegiate Engineers, at Rolla, Mo., and I believe that it would be wise to arrange that the man elected as chairman of Engineers' Day should also be designated as junior representative to the A. C. E. convention. Greater success of our celebration each year, I believe, would justify this action.

I suggest that the executive committee of the Association of Engineering Students co-operate more closely with the chairman of the celebration. Co-operation might be effected by naming the chairman of the celebration as a member of the executive committee of the A. E. S., from the time of his election until his duties have been entirely completed, in order that he may attend the meetings of the committee, outline progress and receive the benefit of suggestions.

Closer supervision of the soliciting and expenditure of funds would be wise, I believe, in view of the fact that the celebration is primarily an A. E. S. function, and the chairman should be given a clear understanding of his responsibilities. A new system of accounting was originated this year, and I suggest that this be adopted for future use, subject, of course, to improvement. This system seemed well adapted to use by the committee, and also it seemed to lend itself well to the careful auditing of the A. E. S. auditing committee.

Finance

A means of gaining financial support from every member of the college was discussed this year, but it failed. Badges were sold at a nominal price, but only about 80 per cent of the students bought badges. This threw the burden of financing upon the dance, with the resultant large crowd. It would seem more fair to make an assessment against every student, or against every member of the A. E. S. if the membership were 100 per cent of the enrollment. Possibly if the date of the celebration were changed to the third or fourth Friday of April the dance could be held downtown, in the Kenwood armory, apparently the only place in the city large enough to accommodate those who would wish to attend. This would afford a greater source of finance. The Kenwood armory apparently never has been available to the college on March 17.

My last suggestion may be a bit unusual, but it seems to be for the best interests of the college and for the success of Engineers' Day. I would suggest that each year the general chairman from the year previous be named as an advisory member of the executive committee. His experience should be of value to the committee, and I am sure that no effort to nominate the committee would be made by the advisory member. I am sure that such a provision this year would have been welcome. It seems always to be a confession of weakness to ask assistance, but where assistance comes as a matter of course, that assistance is welcome.

Sincerely,

HAROLD E. PECKHAM

THE TECHNO-LOG'S TRAVELOGUE

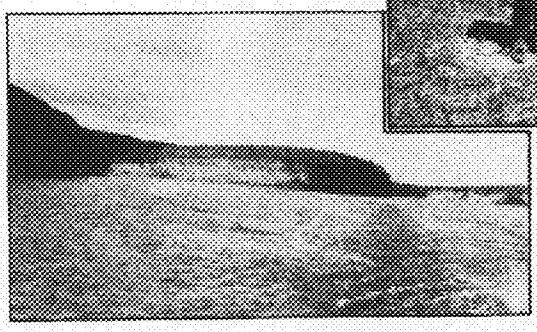
In Which Our Extra Special Correspondents Tell Us Why They Left Canada

By Clarence W. Teal and Alfred B. Greene

Teal and Greene spent more than a month in the northwest this spring, surveying and prospecting for oil. The following is an account of their wanderings and experiences.

WITH the coming of spring comes that unknown calling, a longing for the open trail, that desire to roam; the wanderlust. This, and not the fact that we appeared in the Caliph of Colynos, was the reason that on the following Monday we were bidding "adieu" to our fair city from the rear of a westbound train.

By morning we had crossed the border and were traveling across the level plains of western Canada. Our first stop of any length was at Moose Jaw, from which we traveled west on the main line of the Canadian Pacific Railroad. We rode all day through flat wheat country with never a tree to break the monotony of the landscape. Thousands of ducks and geese could be seen in the swamps and lakes near the right-of-way and jack-rabbits were continually racing along with the train. In the evening we made another thirty-minute stop at Medicine Hat. The city is located in the heart of a deep valley.



(Left)—The Pass
(Right)—Part of the Family

Wednesday morning we arrived in Calgary, another of the new and thriving western cities. Once the center of a great grazing country and later the scene of a big oil boom, it is now the Chicago of the Canadian packing industry.

Edmonton Like Minneapolis

From Calgary we traveled due north through a fertile rolling country of excellent farming land, arriving in Edmonton soon after dark. Edmonton is like Minneapolis in many respects, with its flats down beneath the high bridge, its large stores, its grain elevators and its many railroads. It is the capital of the province and also the location of the University of Alberta. We were quite interested in finding all the students living in dormitories, no fraternities or sororities being allowed. The College of Engineering and of Agriculture were both located in a building about the size of our experimental building. They are to be congratulated, however, upon their progress in the fourteen years

We left Edmonton Friday noon on the regular bi-weekly train, the rival of our famous Arkansas train, on which upper berths are used merely for ornaments. In former years this train averaged eight miles an hour but due to late track improvement it is now able to maintain a fifteen-mile per hour average. But the increase in speed has not increased the advisability of trying an upper. As the little Englishman who had once proclaimed when he rolled out, "This bloomin' bloody thing h'is h'only a place to hang on." The muskeg and wild country has made it exceedingly difficult to maintain a good track bed, especially in the territory near Lesser Slave Lake.

Peace River, a Frontier Town

Just before noon Saturday we got our first view of the Peace River and after dropping eight hundred feet in the next eight miles we arrived at the town of Peace River and the end of the railroad.

Peace River, as a town, deserves mention. It is the beginning and the end of many a man's adventure after wealth. It is the connecting point between river and railroad transportation and is in the heart of a good farming community. At present several oil wells are being drilled in the vicinity, two within the limits of the town, and although no rich strikes have been made operations have not ceased. It is here we find the canoes, scows and motorboats in summer and the dog teams in winter. It is also here that we find the N. W. Mounted Police riding up and down the street in their brilliant scarlet whenever any of the fifteen from the barracks are not out on duty. Peace River is the connecting link between a stern frontier and an onrushing civilization.

As the ice had not gone out of the Peace, we were forced to spend a few days in town. It was here that we first began to get acquainted with the rest of our crew. Washburn, the head of the party, was right at home. He knew everyone and everyone knew him, but it was easy to see that he was anxious to get out into the open away from all towns and traveled roads. Then there was our friend "Mac," the promoter, a large, heavy-set fellow, full of wonderful ideas but working so hard to just keep up the pace of the rest that he found little time for helping with the work. Our cook was a new hand at cooking over an open fire, but he learned rapidly. The tricks of the trade were easy

ning while trying to masticate one of his light biscuits.

The Frontier Dance

The lodge dance, which we attended one evening, was an event which we will not forget. We walked into the hall about nine-thirty and the fun commenced. The boys took us around and introduced

The Authors—Greene Is the One Doing the Jaw-Breaking Act. Note the Look of Concern on Teal's Face

us to their wives, who in turn introduced us to others. During the entire evening we only had three dances with young people of our own age. They danced one-steps, fox trots, waltzes, two-steps, barn dances, French minuets and circle two-steps, one after the other. Between encores the lady takes the gentleman's arm and they proceed to walk around as if in a grand march. Several times we forgot the promenade, much to our own chagrin. At two-thirty they called it a night, so the orchestra played "God Save the King," and we all went home.

Finally the big ice floe, for which we were waiting, came, a grinding, roaring mass on which one could easily have crossed. This mass swept by for thirty-six hours without a pause. After waiting an extra day for stray cakes to clear the channel, we loaded our scow and the Beaulah and after passing the police inspection proceeded to fight our way upstream against the strong current. The Beaulah was a 36-foot flat-bottom motorboat and, although powerful, it had hard work pushing the loaded scow upstream. We made good time, however, passing the Smoky river and the old Indian Mission before noon. When we landed on an island to make our evening camp, we had traveled about thirty miles.

It was here, in our first camp, that we learned the art of making a spruce bough bed. Trimming the tips of the branches and placing them correctly is an art learned only by experience. To those who have never had the privilege of sinking down among these boughs for a sleep under an open sky we extend our sympathy. No hand-made bed can ever be its equal.

At the end of our second day we arrived in Dunvegan, where they have a government ferry, a store, and five houses. This was our last connection with the outside, as no wagon roads extend any further west. From here on we ran into wilder and better game country. At ten o'clock of the third day we sighted a black bear and immediately sought a landing.

The First Bag

Our first hunt was a swift and glorious one. Our boatsman, Harry Weaver, led us in the chase. We scaled the hill, which was only about 600 feet high, only to hear Harry's gun bark twice and to see a black streak and then brown one crossing a small opening in the trees far ahead of us. His gun spoke again and the black fellow ran on alone. Upon catching up with our leader we found that he had neatly dispatched a large black bear with his first shots and a yearling brown bear with his third. We immediately skinned the two animals, saving some steaks for supper from the flanks of the yearling.

After this we saw many bears, but were unable to get within range even though we did learn to climb the hills almost as fast as the natives. Moose signs were abundant and we soon began to see many of them along the river and back up in the hills, although they never waited until we were within range of them.

On the evening of our fifth day we sighted Ft. St. John. It sounded romantic; yes, indeed. The Hudson Bay Company's store, a canny Scot behind the counter, the Vermillion Company's store, the government post, land and telegraph office, a gold dredging outfit, the barracks of the mounties and three residential cabins, and you have a complete picture of the town.

From this point on up to Hudson's Hope there was only one settlement, the one at the mouth of the Halfway River, where there is a very fertile plat with about a half dozen farms on it. We left the Fort early the morning after our arrival, but the engine refused to function in the proper manner, and caused considerable delay. On one of these stops we panned for gold and, although the indications were very poor, we obtained several of the little yellow flakes after an hour's work.

About one o'clock our magneto gave up the ghost so we used the battery until a suitable landing place was found near the mouth of the Moberly River, where we made camp and waited the arrival of the regular passenger boat, which was reported to be only a day behind us. It was here that we had our

"The Party"—Greene Took This Picture

big hunt. Everyone scattered through the woods bent on big game and we found it. Keeler returned for volunteers to carry in some of the meat of a moose which he had killed and John walked in with a very live black bear cub in his arms. Both thought the day a big success and we all agreed after having tasted the fresh moose meat.

At seven the next morning we hailed the Ingineka, a powerful 100 horsepower motorboat

was pushing a large scow laden with freight and passengers. We all piled on, carrying our newly-found mascot with us. There is a peculiar thing about bears—while hungry they make wonderful pets, but when these wants are satisfied they like to nap and if not allowed to fulfill their desire they often become quite ferocious. Another amusing thing was that when tied the little fellow would howl and whine around, but when the rope was removed from his collar he would settle down peacefully and sleep. The men on the boat were all quite interested in our find, but they refrained from playing with him.

The valley of the Peace is from 500 to 1,500 feet deep all the way from Peace River Crossing and the hills are covered with a thick growth of poplar and other trees with considerable spruce. A river flowing all the way from four to ten miles an hour and from a half to a mile wide with high wooded hills on either side is a sight not as easily forgotten as integrals and summations. At one point a portion of the entire hill had once slipped into the river, completely blocking it for 17 minutes and changing the flow of the entire channel. Engineers estimate that there was about a billion tons in the one big slide.

As we neared the Hope the breeze from upriver became cooler and as we rounded a bend in the river we saw the reason. Up ahead in the distance were the snow-capped peaks of the Canadian Rockies. Our attention was, however, soon centered elsewhere. The river seemed to narrow down to a very small opening between two rocky walls not far ahead. Upon getting closer we found that there were two channels through "The Gates," one a deep narrow one between two walls of sheer rock, the other a wide and shallow one leading far off the regular course and through another walled pass. Here was the most beautiful spot of the entire trip: The narrow gate ahead of us, high wooded hills on all sides and the snow-capped peaks rearing their heads in the distance.

From the gates to Hudson Hope was only a few miles of easy going, which we covered in short order. We arrived in plenty of time to unload and make our camp before dark. After leaving us on the south shore the boat pulled across the river, where about thirty people were waiting to greet it. As this was the first boat of the year you can imagine what an excitement its arrival was creating. Mail bags barely touched the ground before they were rushed away to the postoffice, half of the men and the three white women of the town following.

Hudson's Hope is the nicest of all the towns along the way. It is located on a wide bench about 60 feet above the river. It has two stores, a restaurant, a postoffice, a telegraph office and about a dozen houses, and is a rather nice little settlement. After rowing across and visiting the town we returned to our own fireside and after dashing off a few songs to the accompaniment of Al's mandolin we turned in for the night.

A Three-Day Hike

Ever since the good old Boy Scout days we had thought hiking was a great institution. By the time we reached Moberly Lake we were sure of it. It is a three-day trip and thirty-one miles from Hudson's Hope, divided into two parts, the start and the finish. The start took us two days and a half and thirty miles—after that it was easy. The first [illegible] especially for our benefit. We started out by climbing up the side of the canyon for the first four hours, drinking all the cold water we could from the boiling springs at the roadside (non-thermally speaking) so as to be in the best physical trim for the stroll.

The funny thing about the spring season in B. C. is that the frost thaws at the top of the ground first; and the water, hating to leave the old home, stays. Since we were fortunate enough to drop in when the thaw had only penetrated a foot or so we didn't get wet much above the waist. The first ten minutes we tried to step thoughtfully and with precision so as not to get our boots wet—the other seventy-one hours and fifty minutes we spent attempting to see that only nice clean water went over the tops of our boots. After they were full once it didn't matter so much, for since our boots were all carefully waterproofed it couldn't run out. If you ever have to take a hike through muskeg, where each foot has to be pulled alternately out of the mud, be sure and take a gun, an extra heavy Winchester, or a Savage, if possible—it will be such a help, and besides, you might see a rabbit or a partridge to run after.

There is something mysterious about trails like that, even so. Hundreds of years old they are, traversed by fierce Indian tribes that have long since gone to their last hunting grounds; and known only to the wilderness itself are the many stories of hardship and courage; of prospectors come and gone; and of wealth discovered only to be lost again. We wondered at first how anything could get lost, but when we started the guide put us wise. He told us that in two days we would come to a fork in the trail, and to be careful not to go the wrong way. It reminded me of downtown in St. Paul.

The second night on the trail brought us to the fringe of the mountains, and we hobbled the steeds beside a dainty, rippling little brook that had all the earmarks of Niagara's nephew. The snow that had melted in order to keep it full seemed still to be frozen enough to make the water thick. Maybe it was only mud—we couldn't tell after the coffee was made. This particular waterway offered wonderful possibilities as a bathing resort—one of those places where Pathé comes to take pictures of the swimmers chopping out a place to dive through the ice, only here it didn't have time to freeze. Bathing was free, so I unwrapped myself from garments earthly and shouting in advance for help, plunged into the most spacious corner of the hole. An engineer in Shevlin could not have felt more out of place. A million pins stuck into me from all directions, and the bank seemed three times as steep and high as when I made the descent. I scrambled up and made for the fire. I never felt so cold in my life, but just then I slipped and fell in a pile of soft dirt and had to go back an jump in to wash off again. I afterwards grew to sympathize with the dirty Indians we saw later on.

More Scenery

The third day brought us down the winding valley of Moberley River to the lake—twelve miles long and two miles wide; nobody knows how deep. It was a little beauty spot, all right, set down in the midst of nowhere, with snow-topped hills rising on every side, and violets blooming by the shore. It was our destination and our packs were light as we

(Continued on page 26)

USES OF THE STORAGE BATTERY

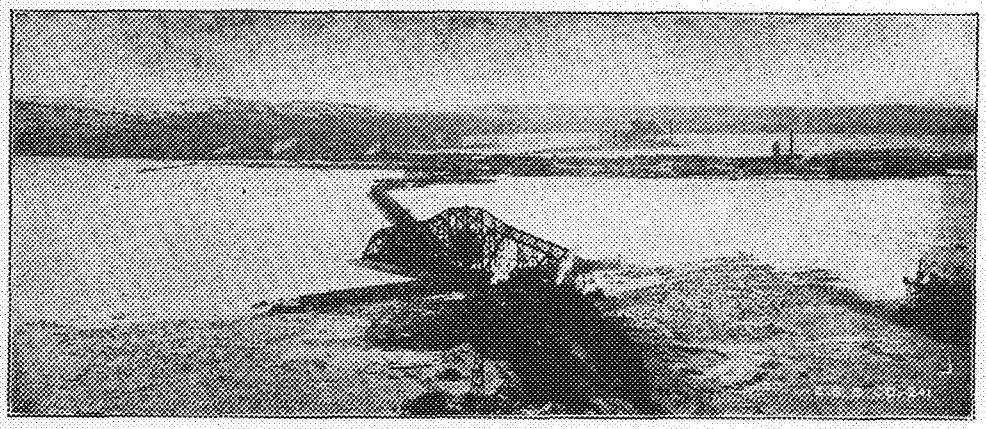
Railroads, Automobiles, and Telephone Companies Create the Greatest Demand

By Albert W. Morse

The author is indebted to the Electric Storage Battery Company for cuts and information.

ONE of the oldest branches of electrical engineering, the storage battery industry, is responsible in no small degree for much of our modern commercial development. With a reasonable amount of care, this appliance will give more dependable and efficient service than any other source of electrical energy, and its application to industry is assuming ever increasing proportions.

The storage battery has its own, undisputed field, no other apparatus having been developed which can take its place. It has three important uses; a portable source of energy, an emergency source of energy, and a constant potential.



Battery Operated Bridge, St. Louis Bay, Duluth

Starting and lighting installations on automobiles, or the lighting of trucks, tractors, and motor boats, is perhaps the most generally known portable application. Eight million batteries are used in this way every day, and the number is rapidly increasing. These represent a considerable investment, but every car owner will agree that the improvement over the old crank and carbide light is worth it. This type is specially built, and is intended for turning the motor over primarily, having a negligible capacity. It is designed to give extremely high discharge rates with practically no voltage drop; the ordinary, small automobile battery is sometimes called upon to discharge as high as three or four hundred amperes.

Motive power requires a large number of batteries. The old familiar pleasure or passenger car is a pioneer application, although in recent years gasoline transportation has taken a decided lead. To compensate for this loss, the industrial truck is rapidly developing. Many thousands of them are being manufactured for factories, warehouses, depots, in fact anywhere material must be shifted within a small radius. The new truck for the University School of Mines is a good example. Underground, we find storage battery locomotives replacing the mule and furnishing transportation wherever trolley installation is inadvisable. The electric street truck is rapidly coming into its own as the most economical means of small-range, frequent-stop transportation.

Railroads Use Many Batteries

The railroads offer another big field. With electrically lighted cars, a storage battery is almost indispensable. When sleeping cars on a side track are entered before they are picked up by the train, the lights that are used come from storage batteries underneath the car. A sixteen-cell installation is commonly used, absorbing the excess energy from an axle-belted generator when the train is running.

The government is a good storage battery customer. Submarines are possible only through their use; the underwater cruising radius requires about 120 cells, supplying power for every purpose while submerged. About a dozen different sets are used in ordinary battleship equipment. For instance, one is carried for intercommunicating telephone, others for gun firing, and still others for turret operation. Army aeroplanes carry them for signalling and starting.

Because of their dependability, storage batteries are used where continuity of service is necessary, and installation as emergency sources of energy is one of their principal functions. Every central station in a city of any importance maintains one or more so-called stand-by batteries. They are generally arranged so they can carry a full direct current load for from twelve to fifteen minutes while the regular supply is being repaired. Breakers or fuses are seldom used, the purpose of the batteries being to insure power without regard to themselves. The Minneapolis General Electric Company has three, and the St. Paul Gas Light Company one. Central stations are using them also for oil switch operation. Wherever the modern type of the solenoid or motor operated oil switch is used, a storage battery is necessary to furnish energy when the sub-station is shut down. Protection on exciter circuits and meter testing require dependable energy.

To give an idea of the size of central station batteries, the three operated by the Minneapolis General Electric Company have a combined capacity of 10,320 amperes for one hour at 250 volts, or power

RECENT CONCRETE EXPERIMENTS

Colorimetric Test, Slump Test, Are Outcome of Work Done at Lewis Institute

By E. S. MacGowan

Mr. Macgowan, the author of this article, has been associated with the Portland Cement Association for more than eighteen years. This paper was prepared especially for the TECHNO-LOG.

I TRUST that I shall be pardoned if I go back 18 years to the time when I first became identified with the Portland cement industry. At that time there were so few text-books upon the subject of concrete and its uses that today it is hard to believe that so little in printed form then existed on a material which was even then so widely used.

I well remember seeking a good book upon the subject of so simple a form of construction as the making of concrete sidewalks and finding the only book available a small pamphlet of about 16 pages.

It is true that in 1905 the book "Concrete, Plain and Reinforced," by Frederick W. Taylor and Sanford E. Thompson, appeared, and soon attained a large sale, but it was not until several years later that manufacturers of Portland cement came to realize the importance of issuing booklets upon the diverse uses of concrete prepared by engineers of experience with this material, and containing simple, concise directions by which men of intelligence would be enabled to secure concrete of high quality.

At no time was there great rivalry even between the largest manufacturers of Portland cement in this matter of issuing booklets and this fact in the light of the growth of the industry is somewhat surprising.

Later was formed the Association of American Portland Cement Manufacturers, which issued a considerable number of booklets upon concrete and its uses, some of which were designed for the contractor, while others were for the engineer or architect. In 1916 this Association was changed to the Portland Cement Association, and under an able leadership and with ample funds contributed by 85 per cent of the manufacturers of Portland cement in the United States and Canada, has made most marvelous progress in promoting both the use of concrete in various structures and also in educating the consumers of Portland cement in other ways of using concrete.

The First Concrete "Bulletin."

To me, the most far-reaching activity of the Portland Cement Association has been in their conduct of the Structural Materials Research Laboratory at Lewis Institute, Chicago, where Professor Duff A. Abrams has been in charge of the Laboratory, with a well selected staff of highly trained engineers and chemists. The work of Professor Abrams has been constantly directed by technicians employed by member companies of the Association. The research work in the Laboratory has been conducted along a number of highly important lines, and two accomplishments have been of the highest service and value, not only to engineers, but to contractors as well. I refer to the work which made possible the production of Bulletin No. 1, entitled, "Design [illegible]" by Duff A. Abrams, and the Duff A. Abrams and Prof. Oscar E. Harder, of the University of Minnesota.

In the investigation preceding the first mentioned bulletin, three years were spent in conducting about 50,000 tests upon concrete specimens made up from aggregates of widely different characteristics with various mixtures as to proportions, size and grading of aggregates with varying percentages of cement and of varying consistency.

The object was to secure definite answers to such questions as the following:

1. What mix is necessary to produce concrete of proper strength for a given work?
2. With given materials what proportion will give the best concrete at minimum cost?
3. With different lots of material of different characteristics, which is best suited for the purpose?
4. What is the effect on strength of concrete from changes in mix, consistency and size and grading of aggregate?

It will be seen that each one of these questions will come up in relation to any important structure in which concrete is largely used. In most cases the structure will contain members which vary in strength requirements. In every structure it is the endeavor of the engineer or architect to secure the best concrete at minimum cost. Upon most structures the locality will present various sources of aggregates from which it is the duty of the engineer to select one or more which are best suited to the work in hand.

Standing out most prominently as a result of these laboratory tests is the discovery of the tremendous importance of the water-ratio; that is, the relation of the amount of water to the amount of cement used in the mix. At no time prior to the conclusion of these tests had any one believed that water-ratio was of such tremendous importance, but the results of these tests proved beyond doubt that concrete consisted primarily of **four** materials: cement, fine aggregate, coarse aggregate and **water.**

Excess Water Reduces Strength

Before the use of reinforced concrete became common, concrete was most largely used for foundations and in mass work, and all engineering instruction and all specifications called for a quantity of water no greater than would produce an appearance of water at the surface when the mixed material had been subjected to thoro tamping. In order to easily and with low cost place concrete in either simple or complicated forms where reinforcing was already in place, contractors began adding an excess of mixing water so that the resulting concrete would flow easily to all parts of the form. It is a tribute to the engineering design and the large factor of safety used that these structures have proven satisfactory in service. This is all the more astonishing when we realize that this "sloppy" consistency reduces the possible strength of the con-

Professor Abrams has shown that the strongest concrete, other conditions being equal, will be secured when the amount of water is so small that a mixture is no damper than moist earth, but he has also recognized that for certain classes of concrete work, so dry a mixture can not be used commercially, and has laid down as a safe rule: **"Use the smallest quantity of mixing water that will produce a plastic or workable concrete."** The results of his tests show that the addition of as small an amount of water as one pint more than is necessary in a one bag batch, decreases the strength of concrete as much as if two or three pounds of cement had been left out. I well remember watching the construction of a building of reinforced concrete and mentally checking the mixture being used. As I had previously known that the mixture was 1:2:4, I was surprised to find that a greater amount of cement was being used than was called for in the specifications. I spoke to the general contractor who was on the job, asking him if this was correct, and he proudly stated that he was adding an extra amount of cement at his own expense, as he considered the small additional cost to be justified, and wished to do a high class piece of work to uphold his reputation as the leading contractor in the city. Excess water was being used upon this job to such an extent that it is doubtful whether the extra amount of cement he was using was sufficient to counterbalance the loss produced by the excess water in the mix.

Prior to the research work of Professor Abrams, proportions for concrete were made by several different methods, one of the most common being an arbitrary selection, such as a 1:2:4 mix without examination or scientific investigation of either the size or the grading of the fine and coarse aggregates. Attempts were also made to secure an aggregate of maximum density, but no scientific method existed for successful conduct of such endeavor. Various investigators had established a curve which was set up as a standard and to which grading of the aggregates was made to conform as closely as possible. There had also been investigation of concrete mixes based upon the surface area of aggregates, but there had been no thoro investigation scientifically conducted upon large numbers of concrete specimens in order to secure definite results.

So far as the arbitrary selection of fixed quantities of fine and coarse aggregates was concerned, it was common knowledge among engineers and contractors that this method was far from satisfactory, comparing job to job, for the reason that in each locality there was a considerable variation in the quality of the aggregates, as well as in their size and grading.

Seventy to Ninety Per Cent Maximum Strength Attained.

It is possible in general construction work to obtain from 70 to 90 per cent of the maximum strength and yet have a mixture containing sufficient water to be worked with ease and economy. Such a percentage would be much greater than is usually obtained, for most concrete, as placed today, has from 50 to 100 per cent more water than is necessary, and hence attains but half or even one-quarter of the strength that is possible with a workable mix.

In the making of common concrete products, such as concrete block, concrete brick and concrete drain tile, the amount of water used generally must be less than is necessary for maximum strength. If the products are to be removed at once from the molds, a very stiff mortar is necessary, and usually contains too little water. If a sufficient amount of water were used to secure maximum strength, the mix would be so plastic that it would become distorted when deprived of the support of the mold. To successfully cure such products they must receive both heat and moisture, which is generally done by the use of steam curing chambers in which the products are subjected for a period of from 24 to 48 hours to a vapor produced by wet steam, aided by steam heat from radiators, or to live steam whose high temperature is lessened by the effect of cold water vapor from "fog-heads." Such treatment serves a double purpose, first by adding the amount of water necessary to perfectly hydrate the cement, and second by hastening the hardening of the concrete, thus allowing the products to be handled more promptly to the storage yard. It is seldom that concrete products that are only cured by sprinkling will be found to possess normal strength for the mix and cross section.

In the building of structures of reinforced concrete, there is another serious objection to the use of very wet mixtures, in that the forms are seldom water-tight, and as the mixing water readily carries the cement in suspension, a considerable amount escapes thru the joints of the forms, thus reducing the ratio of cement to aggregate. That this loss is considerable may be readily observed on nearly every job of reinforced concrete.

The "Slump Test."

As a means of accurately testing the consistency of concrete on the job, the Research Laboratory produced simple apparatus for a "slump test." A form of sheet metal is made like a frustrum of a cone, 4 inches in diameter at the top, 8 inches at the bottom and 12 inches high. To work the concrete into this form, a pointed metal rod 21 inches long and ⅝ inches in diameter is used. To ascertain the slump of the concrete to be tested the form is filled quickly in three layers of about 4 inches in depth, rodding each layer 30 times. The form is then lifted and immediate measurement made of the settlement or slump.

Concrete which slumps only ½ to 1 inch contains but little more water than is necessary for maximum strength; however, it will be too stiff for most construction work. This consistency has been given the relative rating of 1.00. If the concrete contains 10 per cent more of water, it is rated as having a relative consistency of 1.10, and the slump will be from 3 to 4 inches. Twenty-five per cent more gives a relative consistency of 1.25, and produces a slump of 6 to 7 inches. Proceeding further, an increase of 50 per cent of water, rated as a relative consistency of 1.50, will give a slump of 8 to 10 inches. Given the character of work to be done, and using the minimum slump as given in the Standard Specifications for Concrete and Reinforced Concrete, tests can quickly be made on the job, using samples obtained from the mixer. Corrections of the quantity of mixing water used can be made at once, and the test is so simple and so quickly performed that it may be made frequently by any competent inspector or foreman. The slump test gives an infallible method for proportioning the water to be used with aggregates which vary from day to day, or even from hour to hour, in the

amount of moisture which they contain. All batches will have the same consistency, producing a concrete of more uniform strength.

Use of Hoisting Towers.

A few years ago contractors began the use of hoisting towers and chutes for placing concrete on large buildings. The mixed concrete is dumped into a skip, which is elevated and dumped into a hopper, whence it flows thru a spout or trough, generally of metal, to the point where it is to be placed. The use of such apparatus saves time and money, but if the metal spouts are reduced to a slope of less than 35 degrees, the amount of water necessary to produce reasonably rapid flow of the concrete is so great that a serious decrease in the strength of the concrete is certain.

If wooden spouts are used the slope must be greater, for the concrete will not flow so readily as over metal, and such spouts cannot readily be kept clean of encrusted mortar.

The second accomplishment of the Structural Materials Research Laboratory was working out and perfecting a simple test for detecting organic impurities in sands.

For many years contractors and engineers had been puzzled by the behavior in concrete of sands which were apparently clean, showing but a small percentage of clay, yet which produced concrete which set very slowly, and when thoroly hardened showed very little strength.

Numerous tests had been devised to determine the cleanness of sands, the most common one being for determination of silt, which could be done in the field. A laboratory test was also in use for determining loss in weight resulting from heating the sand to a red color. Determination of silt in the laboratory could be made very exactly, but the result gave no information as to the probable reduction in strength and durability of concrete made from such sand.

Work in the Research Laboratory brought out the fact that it was the presence in the sand of organic impurities of a humus nature which caused slow setting and lack of hardness in concrete made from sands containing organic matter. In general this humus came from careless stripping of gravel pits where a portion of the overburden was allowed to become mixed with the gravel. However, investigations have shown that such organic matter exists in sand lying several feet below the overburden. Such sands when washed will show practically no silt, and the only method of determining whether organic impurities exist is the colorimetric test. Laboratory tests show that organic impurities, even in very small percentage, injure concrete far more than a comparatively high percentage of silt.

A Very Simple Test.

The method of making the colorimetric test in the field is so simple and requires so little and such inexpensive apparatus that it commends itself at once to the engineer. All that is necessary is a quantity of from 16 to 32 ounces of a 3 per cent solution of sodium hydroxide (NaOH), and one or more 12 ounce graduated prescription bottles. In operation sufficient of the sand to fill the graduated bottle to the 4½ ounce mark is used. To this is added sufficient of the solution so that the volume of the sand and the solution after shaking amounts to 7 ounces. The mixture is shaken thoroly and then allowed to stand for 24 hours. If at the end of this time the solution is colorless, or has a color no darker than light yellow, the sand may be considered as safe for use, so far as organic impurities are concerned. It is, of course, possible to obtain in less than 24 hours a good idea as to whether or not organic impurities exist in the sand in appreciable or dangerous quantities. I have found several samples of sand which, in from 30 minutes to two hours, would show so dark a color in the solution as to reject them for use unless thoroly washed. Thoro washing to such standards as are in commercial use will greatly reduce the quantity of organic matter present in the sand. Even with such washing, however, tests should be made of the resulting washed material, in order to determine whether there remains a sufficient amount of organic matter to prove harmful.

As the cost of the necessary apparatus is less than a dollar and can be secured at any drug store, this test should **always** be made upon any sand which is being considered for any class of concrete work. Because the apparatus is so cheap and simple, the test can be used constantly in checking the cleanness of sand as received on the job, thereby guarding against delivery of sand otherwise good, the quality of which, however, has been lowered by careless stripping of the pit.

In connection with this test, the Research Laboratory has issued a colored chart showing five plates, varying from light to dark, and altho definite values for the reduction in strength of concrete corresponding to the different colors of the solution can not be exactly stated, tests have shown the relation to be approximately as follows:

1. None.
2. 10- 20 per cent.
3. 15- 30 per cent.
4. 25- 50 per cent.
5. 50-100 per cent.

In investigating complaints where it has been reported that the concrete set very slowly and attained but little strength, it is my practice to first make the colorimetric test. In every case so far investigated the test has shown a high percentage of organic matter present in the sand, and even tho the user had little knowledge of concrete, no considerable difficulty was encountered in convincing him as to the fact which had led to his failure to secure concrete of good quality.

Gravel Pits Seldom Stripped Properly.

It is very seldom that gravel pits are properly stripped, and where the pit is not worked commercially with proper machinery the above fact is always true, and the colorimetric test should be first applied in determining whether the gravel is to be used on the work proposed.

Had the investigations in the Structural Materials Research Laboratory for the past several years given us nothing else than the Bulletin on Design of Concrete Mixtures and the Circular on Colorimetric Tests, the money spent on conducting the Laboratory was well invested.

The transmission of power from Niagara Falls to New York by wireless has been predicted as a possibility of the near future. The prediction came as a result of the success of a sixteen-hour test of electron tubes in the place of large alternators in transmitting wireless messages across the Atlantic Ocean. Scientists have, for some time, believed that wireless transmission of power might come to pass.

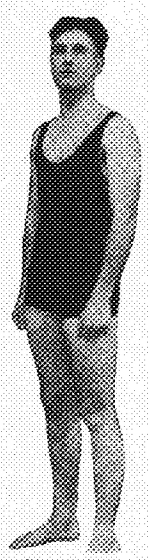
SPORTS

SWIMMING

Being Conference champions, the Gopher swimmers have a reputation to sustain, and the indications so far are that this year's team will be able to uphold the weight of a Big Ten championship. Coach Thorpe has most of last year's team back, and is strengthened by the addition of Hugo Hanft in the dashes and Harold Bird in the fancy diving, both of these men Engineers, by the way. The team has been working hard and faithfully since the first of November. The result of hard practice has been evident in the two practice meets so far run off.

The first meet of the season was with the Minneapolis "Y" team, for a number of years rated as one of the strongest in the Northwest, but this year weakened by the loss of a number of men. Coach Thorpe used only a few of his veterans in this meet, using the opportunity to discover how his new men would perform under fire. The meet was an easy victory for the Gophers and Thorpe expressed himself as well pleased with the showing his proteges made.

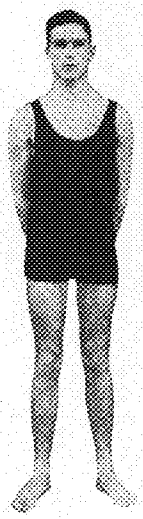
A week of hard practice was put in after the "Y" meet in preparation for the meet on January 26 with the much-touted team from the St. Paul A. C. For a practice meet the affair proved a humdinger, and, since good opposition was expected, Thorpe used the team that will later strive for conference honors. The meet was featured by the breaking of a world's record by Faricy of the Gophers, and by the setting of two local records by Gow. Faricy swam the hundred-yard breast-stroke in 1:10$\frac{4}{10}$, $\frac{2}{10}$ of a second under the existing world's record. However, the record will not stand, since the meet was unofficial, and the Gopher tank is an inch short of the standard distance. Gow's records were set in the 40- and 100-yard dashes.



Engineers are heavily represented on the team. Captain Murry Lanpher, performing as usual in his favorite event, the 220, is attaining new fame as lead-off man on the relay team. Hugo Hanft holds down a place on the relay, swims the 40 in fast time, and makes Gow step in the 100. Harold Bird is showing such form in the dives that he took first place in that event from the St. Paul A. C. Horace Nutting is showing the stuff in the plunge that will make him a man to be reckoned with in the conference. Hib Hill holds down a berth on the relay team. Ludvigsen and Craig, two of Thorpe's utility men, showed well in the Minneapolis "Y" meet, and with more seasoning will be varsity caliber.

An excellent schedule has been arranged for the Gopher swimmers, comprising meets with Chicago and Northwestern and Iowa at Minnesota, and winding up with the Conference meet in Bartlett pool, at the University of Chicago, March 15-16.

A summary of what Engineers are doing in the major winter sports shows that we have two men, Pesek and Bergsland, on the basketball team, and probably Severinson after Feb. 10; three men, Pond, Swanson and Ben Bros, on the hockey team; and five men, Captain Lanpher, Hill, Hanft, Bird and Nutting, on the swimming team. Sounds pretty good, eh?



Capt. Murry Lanpher

The Freshmen sprang a surprise in their game with the Juniors and came near winning, the final score being 14 to 10. The Freshmen have a light, fast team, and on a larger floor would be a tough proposition for any of the heavier upper-class teams. This game was the best that has been played so far.

Freshmen	Lineup	Juniors
Foster	RF	Tews
Norman	LF	Cass
Johnson	C	Braddock
Hanna	RG	Franz
Dunshee	LG	Donahue

Subs — Juniors, McLelland, Dement, Wilson. Freshmen, Bakkin.

Baskets — Norman, Bakkin, Johnson 2, Hanna, Franz 2, Braddock 2, Cass, Tews 2.

These games have brought out some good basketball material and the Engineers' team picked from the class teams is sure to be a strong contender for the all-college championship. The colleges have been divided into two divisions: Division No. 1—Foresters, Miners, Dents, Chemists and Engineers; Division No. 2—Ags, Medics, Pharmacists, S. L. & A. and Laws. The winners of each division will play for the all-college title.

The schedule for the Engineers is as follows:

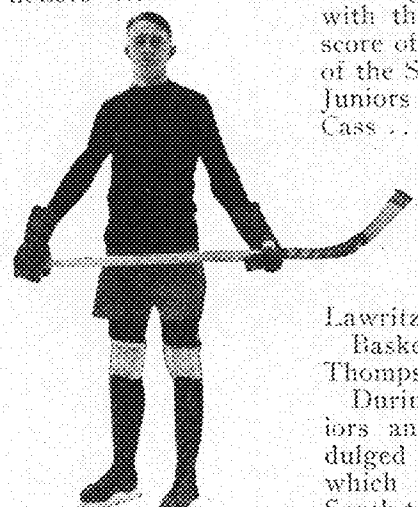
Foresters—Feb. 14.
Miners—Feb. 19.
Dents—Feb. 23.
Chemists—To be arranged.

Arthur Jacobsen, Sophomore Electrical, has been elected to captain the cross-country team next year. He was one of the best runners on the varsity squad during the past season and will have two more years of competition. He is the only

HOCKEY

Getting off to a whirlwind start in her second season of Conference hockey by taking two straight from the strong Michigan six, the Gophers seem headed for the top of the Conference pile.

Ramsey Tech served to open the season, and went down to defeat by a 6-1 score on the Hippodrome ice. St. Thomas took the short end of a 4-0 count a week later in a rough game. These two opponents gave the Gophers the necessary seasoning for their Conference start against Michigan on Jan. 22. The first game of the series went to Minnesota by a 2-0 count and was featured by the work of the three Engineers playing for Minnesota. Pond, playing his first conference game, was the individual star of the game, and made the first counter on a pretty pass from Paul Swanson, also of the Engineering contingent. Ben Bros replaced Swanson in the last period and finished the game in nice fashion. The second game again showed the Gophers' strength when they emerged on the long end of a 3-0 score. Pond and Swanson played their usual good game, Bros dividing honors with Swanson at center. A feature of the two games was that not a penalty was called on either team. Schade, in Minnesota's goal, made 17 stops to his opponent's 49.



Paul Swanson

The Gophers have a good schedule this year. The showing they are making ought to go far towards earning the coveted Major "M" for the first string men.

The hockey schedule so far:

Jan. 30—Hamline at the Hippodrome.

Feb. 9-10—Wisconsin at Madison.

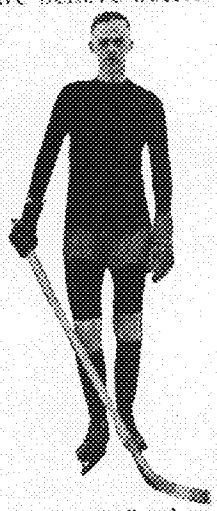
Feb. 16-17—Michigan at Ann Arbor.

Feb. 26-27—Wisconsin at the Hippodrome.

Games with the Michigan School of Mines, the University of Manitoba, and with Notre Dame are pending, but have not yet been scheduled.

VARSITY BASKETBALL

The Conference basketball race, so far, has been a great disappointment to Minnesota followers, but we believe better times are coming. The return of has been responsible for most of the Gopher scoring so far. This team is sure to improve with each game and is liable to prove a stumbling block for several of the leading teams later on.



Captain Rudy Hulteranz is doomed to stay on the sidelines for the remainder of the season, as his football injury persists in bothering him.

INTER-CLASS BASKETBALL

With the inter-class schedule half-finished, the Sophomores are leading, with a perfect record. The Sophomores are determined to finish without a defeat, but Ray Ecklund to the squad made a big difference in the Wisconsin game, although he was a little off color on account of lack of practice. If Severinson can pass his comprehensive exam., which he will take sometime before Feb. 10, another experienced man will be available for the team. Until Severinson returns to the team the lineup will be: Ecklund and Vancura or Foote, forwards; Pesek, center; and Bergsland and Levis, guards. Levis has been developing into a good stationary guard and, although lacking in experience, is a willing worker and has lots of fight. Grant Bergsland has been playing a good game and together with Pesek, they will hit pretty rough sledding when they line up against the Juniors and Freshmen.

Ben Bros

In the first game the Seniors had an easy time with the Juniors, winning the game by a score of 10 to 5. The poor basket shooting of the Seniors kept the score down.

Juniors	Lineup	Seniors
Cass	RF	Tennstrom
Tews	LF	Olson
Dement	C	Thompson
Franz	RG	Mitchell
Mayer	LG	Nelson

Subs.—Juniors, Donahue, Moore. Seniors, Buhr, Manger, Leonard, Lawritzen, Defreece.

Baskets—Tews, Franz, Mitchell, Nelson, Thompson 3. Free throws—Tews, 1.

During the next game, between the Seniors and Sophomores, basketball was indulged in for the first five minutes, after which the game resembled a mob or a South-town gang-fight. The refereeing was rotten, but the referee figured that his wasn't the only work that was rotten. At the end of the regular playing time the score was tied, 12 to 12, the Sophomores winning out in the overtime period, the final score being 14 to 12.

Sophomores	Lineups	Seniors
Brisson	RF	Tennstrom
Bros	LF	Olson
Burns	C	Thompson
Tatham	RG	Mitchell
Freberg	LG	Nelson

Subs.—Sophomores, Galvin, Haiina, Burly, Larson. Seniors, Manger, Curry.

Baskets — Olson, Thompson, Nelson, Manger, Burns, Haima 2, Bros 2, Brisson 2.

Free Throws—Olson, 4 out of 6.

When the Engineers' basketball team plays their inter-college games, they will wear new outfits furnished by the Engineers' Bookstore. The Bookstore is doing this in an effort to boost intramural athletics.

Phil Hartman is the new Sophomore athletic manager, taking the place of Matthew McMillan, who has left school; and Leonard Wickland is the Freshman manager, taking the place of Earl Hagen.

ALUMNI NEWS

Some time ago a letter was received from Harry MacKenzie, Arch. '25, stating that the birds of Northern Minnesota had all gone south, and that he was starting soon. A few days later he appeared around the department resembling a cross between an English sportsman and an American brakeman. He disappeared and letters came from several points south and souther. (Evidently using various means of travel.) The last reports indicate that he is making Miami, Florida, an extended visit, filling a position as seaman on a private yacht. He has written from Miami of some of his experiences while "off duty":

"The best money I've made so far was off an old fish-eating pelican. I was sitting on the city pier watching those fool birds filling their internal organs until I nearly passed out 'lawffing' at them. They are nearly as graceful as an elephant on crutches or a crocodile on stilts. Mrs. Pelican flops her wings over the balmy sea breezes until she sees a fish. Then she turns a double somersault, takes a flop, does the tail spin and falling leap into the water with a splash big enough to swamp any boat within a radius of four miles. I wondered why the old birds never broke their necks. Then slowly but surely received a flash of intelligent thought. I took a board, and, after buying a small fish, tied it to the board and threw it out to sea. Flop comes Mrs. Pelican when she spies Mr. Fish, and out goes Mrs. Pelican's lights when she hit the board. I rowed out and picked up the bird, which 'came to' in a few minutes. I had a merry time for the next thirty minutes till I got her tied up. I was walking up the street with the pelican under my arm, when a woman stopped her 'Rolls Ruff' and offered me ten dollars for that 'beautiful bird.' I hope she got the darn thing home without getting killed."

W. K. Cooke, C. E. '22, who has been with Croft & Boerner, Minneapolis, has been appointed structural designer with the Elgin, Joliet & Eastern Railroad, at Joliet, Ill.

W. Seeman, '20, formerly with Elgin, Joliet & Eastern Railroad, is now with James Colin Co., Minneapolis.

Harry J. Andrews, E., is at Brookline, Mass., preparing to enter Boston Tech.

Reinhold Melander, '21, who has been teaching architecture in the College at Fargo, was in the city recently at an American Institute of Arts convention. Reinhold was last spring made a member of Theta Xi, engineering fraternity.

W. Kendall, Arch. '23, is also teaching at Fargo.

Gertrude Quin is teaching freehand drawing and history at Hackensack, Minn.

Walter D. Suplow, E. '17, who has been a part of the American forces in Germany, is now stationed at Fort Mott, Salem, N. J.

Eugen S. Fallon, E. '14, with Mrs. Fallon and Eugen, Jr., is now residing in Niagara Falls, N. Y., superintendent of the Aluminum Company of America. He started work with the company the first of December, 1922. The company has several factories throughout the country, with headquarters at Niagara Falls.

Theodore L. Vallacher, C. E. '20, left Minneapolis recently for Northern Minnesota to work on a power plant survey for R. D. Thomas, hydraulic engineer. He was accompanied by his wife.

Dewey Mattson, C. E. '22, passed through Minneapolis during the Christmas holidays on his way to his home in Wisconsin. Incidentally he visited the University. He is with the Minnesota Highway Department, and is stationed at Two Harbors.

C. A. Thompson, B. Sc. '22, is also at Two Harbors, employed by the Minnesota Highway Department.

Ed. C. Erickson, C. E. '22, employed in the U. S. Engineer's Office, Milwaukee, spent a week in Minneapolis during the holidays.

Edward H. Adams, B. Sc. '22, is now at the head of his own construction company, at 219 Essex building, Minneapolis.

Lawrence E. Teberg, E. E. '22, captain of the 1921 football team, was married on October 14 to Annabel Drenckhahn, of Minneiska, at the bride's home, and left immediately on a wedding trip, destination and date of return not announced.

Florian Kleinschmidt, Arch. '20, having received his Master degree from Harvard, is doing the designing for the firm of Lund & Lund, contractors, Minneapolis.

In the 1922 "Who's Who" may be found a creditable showing of names from the faculty of the College of Engineering, Architecture, and Chemistry. Among those listed as leading citizens of the United States are the following: L. D. Coffman, President of the University; Ora M. Leland, Dean of the College; J. J. Flather, Professor of Mechanical Engineering; W. E. Brooke, Professor of Mathematics and Mechanics; George B. Frankforter, Professor of Organic and Industrial Chemistry; F. M. Mann, Professor of Architecture; G. D. Shepardson, Professor of Electrical Engineering; F. W. Springer, Assistant Professor of Electrical Engineering; and P. H. M. P. Brinton, Professor of Analytical Chemistry.

E. F. Norelius, M. E. '08, for a number of years a consulting engineer in Minneapolis, has taken up the same work in Detroit, Mich.

Roy Aure, M. E. '22, of Canby, Minn., is with the MacKay-Kellog Co., of Minneapolis.

P. D. Runkel, M. E. '22, is a construction engineer with the Northwestern Bell Telephone Co., in Minneapolis.

Dewey Mattson, E. E. '22, is employed as office engineer for the State Highway Department, on construction project No. 1-01, between Little Marais and Two Harbors, Minn. This includes the con-

THE NEW TECHNOLOGY

By F. J. Whiting

The buildings constituting the "New Technology" are so arranged that they spread over about fifteen hundred feet along the Charles River Basin, fronting which is the principal façade of each.

The buildings are reinforced concrete. The exterior walls facing the courts and the streets are limestone, except for a low granite base course at the ground level. The other walls are buff brick, with limestone trimmings.

The main entrance, with its portico of large fluted Ionic limestone columns is surmounted by a reinforced concrete dome, which is 180 feet high, and is surfaced with limestone.

The reading room of the library is situated in the great dome, from which comes ample light through windows and vault lights set in the dome itself. These windows, hidden by parapets, are invisible from the outside.

Students in the two Engineering Drafting Rooms work under skylights in the roof. Large windows also admit a generous supply of daylight. The semi-indirect electric lighting system, supplemented by desk lights, permits work to continue during the evening when necessary.

The Laboratory of Mechanical Engineering is constructed as a large bay with a traveling crane. Below the crane is the steam and hydraulic machinery of the laboratory, including a Corliss engine, used for various kinds of engine test work.

Eastward of the educational group facing the river is the Walker Memorial, erected by the alumni in memory of General Francis A. Walker, former president of the Institute. It is the club house and headquarters for the students, a meeting place for the various activities of club life.

The Memorial is a three-story reinforced concrete building, beam and girder type for the first two floors and steel trusses on the third floor over the gymnasium and supporting the roof. The exterior walls are Roman brick with limestone trimmings. There is an imposing entrance from Charles River Road, consisting of a broad flight of limestone steps and a portico of Doric limestone columns.

Looking further eastward along the Cambridge waterfront, we have the dormitories and the president's house. Every section in the dormitory buildings has its own entrance and staircase, making each a complete unit. The dormitories have 130 rooms, accommodating approximately 230 men.

The President's house faces the Charles River. It is surrounded by a wall enclosing at the back a formal garden with brick walls, tea house, fountain and shrubbery. There are sixteen rooms and five baths above the basement; and ten rooms, two lavatories and one bath in the basement. All floors above the basement are oak. The living room, reception room, dining room and library have finely panelled walls, parquetry floors, ornamental ceilings and imposing fireplaces. The area occupied by the house and garden is two hundred feet square, and the wall surrounding it is of buff brick and limestone, eight feet high.

The Engineering Library is compiling an index file of all stories that have been published in the Techno-Log. This system will facilitate the task of finding any article and save the time formerly

HOW ABOUT THE SUCCESSES?

There is one question you can ask any senior engineer and in nine out of ten cases get exactly the same answer. The question is "What are you going to work at, after you graduate?" and the answer, "I don't know." The frankness of this answer can hardly be doubted in the light of the oft-quoted statistics that 80 per cent of the students who graduate from the engineering courses never go into technical engineering, and of those that do, only about 40 per cent take up the particular type of engineering they were prepared for. Let us examine, if we can, some of the probable reasons for this state of affairs.

In the first place, there is a very general lack of accurate knowledge among students in regard to the exact nature of the work they will be called upon to do when they are practicing their profession. There is too much ignorance about the practical requirements of the various occupations. The course in orientation offered the freshmen is a step in the right direction—but only practical experience and knowledge of actual conditions in the field can accomplish what should be done in this line.

Another factor that tends to put a student at a loss in locating himself is lack of information about the opportunities that are open to him. Given a certain training, what type of job can he get? An all-engineering employment commission, which could locate jobs and present the actual details of each position to the student would give him a chance to weigh one against the other and pick out the job that suited his tastes and abilities the best. At present, the result of this indecision is that the graduate takes the first position offered him; for it is very hard for one man to locate a number of opportunities from which to choose.

At least one other reason for unbalancing the student is the shock he receives when he first is offered a job by some big company at from $80 to $90 a month accompanied by the promise of lots of experience. This comes as the culmination of many stories that are told him of graduate engineers who start at the drafting board and get into a rut, reaching the height of their career with the title of Chief Engineer and a salary of $2,000 a year. You may argue that these are only the failures, but so numerous are they that to say the least it somewhat appals one. These things make the average student a little ashamed of his future profession and form a tendency toward commercialism where the promise of high rewards, in kind, is held out. What is needed are more examples, freely advertised, of the truly successful engineer, independent, loving his work and able to make from ten to fifteen thousand dollars a year, by his own efforts at pure engineering.

Of course, there are successful men who believe that it makes not much difference what line of work a man follows—if he be of the right calibre he will succeed and if not he will not succeed. But more and more it is becoming evident that the round peg in the square hole proposition is responsible for most of our failures. Let us try to develop the student who knows what he wants when he leaves high school and heads straight for it without vacillation; for in this lies the greatest prospect of success.

Basil C. Maine, E. E. '22, is an instructor in The

EDITORIALS

THAT PLEDGING QUESTION

Fraternities are recognized as an invaluable portion of campus organization. Theoretically they are its greatest power for the promotion of good fellowship among college men; for the development and support of campus activities, athletics, college spirit and, what is of primary importance, scholarship, that one function which is the reason for a university. Actually they do tend toward these things but they are prevented from the highest possible achievements by certain campus customs. One of these deterrents is the pledging of freshmen.

Among the professional fraternities, the belief is pretty well established that no freshman should be admitted to any fraternity, dramatic society, or any other organization apt to disconcert.

It is rather ridiculous to assume that any fraternity can choose, without at least a year of close observation, one who will be a "brother" for the rest of his life. And from the purely selfish standpoint it is an impossibility to select those who will be of the greatest good to the fraternity and to the school, in the short time of fifteen days.

Furthermore, the man himself should be permitted the privilege of becoming sufficiently acquainted with the conditions so that when the time comes he can make a just decision, and is not rushed off his feet by a period of concentrated "rushing" and attention. Under the present conditions the continual fluctuation due to the loss of men during the first fatal year makes a very inefficient machine.

These considerations, with the additional one of the admission of men who are, to say the least, uncongenial, should be argument sufficient for a longer period of observation for both parties. Apparently it is not, for no move to attain this end has ever survived in the inter-fraternity council, even in the face of the remark by its president, that fraternities within one year would be 30 per cent stronger, if they adopted the plan.

And as no single organization can undertake to limit its potential possibilities for pledging without losing a great number of the good men, under the present system, the solution must come through the authorities. The people who guide this college should rule that no person registered in the College of Engineering and Architecture should be pledged to any fraternity of any nature until he has attained sophomore standing.

EDUCATION

The following statement was written by Dean Kimball of the Engineering College at Cornell University. It is relative to that particular engineering college, but it applies equally well to the College of Engineering at the University of Minnesota. Dean Kimball is one of the leading engineers of the country. He is past president of the American Society of Mechanical Engineers, and has served on a number of important committees. We have previously expressed our views in this article, and we feel justified in reprinting it here.

"Education is something more than 'telling.' The one great desideratum in education is an opportunity for students to come into close contact with mature and inspiring minds.

"There is one phase of this problem, however, that is peculiar to professional schools, namely, the competition of industry for the brightest minds. Not only does this competition render it difficult to attract the most competent, mature men of the professional callings to the educational field; but it is becoming equally difficult to attract or hold young and promising men even at the advanced salaries made possible for these younger men by the work of the Endowment Committees.

"Research is just as much a part of true university work as is teaching, but the financial problem of providing instruction for the greatly increased undergraduate body, especially in the College of Engineering, has greatly reduced the possibilities of advanced study.

"The College of Engineering will not be complete until it possesses sufficient equipment and such adequate financial support as will make possible a real graduate division of research."

—DEXTER S. KIMBALL.

A. A. E. IDEALS

The following paragraphs are excerpts from a report given by the American Association of Engineers' Committee on the Amplification of Ideals and Objects of the A. A. E. They are of particular benefit to young engineers, who, in this age of the rush for the "almighty" dollar, may overlook some of the principles upon which true success in life is based.

"Remuneration: The engineer receives his pay, or reward for services, in two ways: First, and most obviously, in money—enabling him to support his family and himself; and Second, in satisfaction, or in recognition by others of the value of the work performed. All of the professions are thus distinguished from other occupations, trades and businesses. In them, men are held—not so much by the money paid, as by the satisfaction in the work."

"Public Relations or Citizenship: The full satisfaction of life, liberty, and the pursuit of happiness can be felt only when he is able to fill his proper place in society, especially as a leader in those things in which he has been educated, largely at public expense, and which demand his attention. The older professions emphasize this fact, and have impressed upon the young man entering the profession the fact that he should 'be a leader in his community, in learning, in dignified and manly bearing, and in courteous and better treatment of his brethren, to the end that the profession may occupy that place in its own and in the public estimate to

CHEMISTS

GAS WARFARE.

On Thursday, January 18th, Captain Embich, of the United States Army, talked to the Chemists Club about the uses of gases in modern warfare. He gave the historical setting of gas warfare, telling how the Germans scored a complete surprise the first time gas was used, and how the first crude gas masks were made from cotton gauze soaked in soda solution to absorb the chlorine. He then followed thru the development of the modern mask, with its charcoal and soda box, which had to be evolved to protect against the numerous gases that later came into use.

Captain Embich discussed the mustard gas and stated that the only protection would be a rubber suit, since this gas attacks all parts of the body. However, such a suit was found impracticable, because it lowered the man's efficiency to such a marked degree that he became almost useless as a fighter. The captain further stated that the only hope in gas warfare is to manufacture more gas and do it faster than the enemy.

The Freshman Chemists held their first meeting of the year, which was purely business, on Thursday, Jan. 11th. But for a time the assembly forgot its mission and it became necessary to elect a sergeant-at-arms. When Gerald "Spike" Plattner accepted this new office, order was restored and the Frosh then proceeded to discuss and vote upon the proposed constitution of the class. As the School of Chemistry had received recognition to the Freshman Commission, a representative, Richard Harvey, was elected to that body. "Brud" Griffith was elected to the Chemistry Student Council to fill the vacancy made by Donald Dukelow, who resigned upon his changing to the College of S. L. & A. Last reports state Brud is still in the council. The social committee has something up its sleeve, and indications are that it will soon drop out, either in the form of a luncheon, or an All-Chemistry dance.

The problems confronting the sanitary engineer and their importance, was the subject of discussion at the January meeting of the Minnesota Section of the American Chemical Society. Speaking on "The Activated Sludge Process of Sewage Disposal," Dr. Edward Barton, international authority on the subject of sanitation, described municipal and industrial sewage disposal plants, both in Europe and the United States.

Having emphasized the importance of sewage disposal to the growth of the American city, Dr. Barton spoke in particular of the activated sludge process used at Houston, Texas. There the process is carried out in large tanks where the liquid sewage is aerated and into which the sludge, sediment obtained previously from other sewage, is introduced, causing the solid particles to settle out, leaving a clear, supernatant liquid. This sludge is a good fertilizer, and is now being sold to a Georgia

of the Houston plant, Mr. Fewgate, was in the audience, and, after listening to the discussion of his plant, spoke a few words about its problems himself.

The material upon which Dr. Barton's discussion was based was largely the result of his own research. An important feature was the lantern slides of the various plants, which were a great aid to clarity. On the whole, the lecture was clear, direct, and interesting, well repaying the large number who attended.

KOPPERS COKE REVEALED

The Chemists' Club journeyed to the Minnesota By-Product Coke Co.'s plant in St. Paul on Saturday afternoon, January 20th. This plant uses the Koppers by-product method and is consequently known to most people as the Koppers plant.

The forty or more pilgrims first watched the process of discharging the ovens. Twelve and one-half tons of white-hot coke were pushed from the oven into an electric car, which immediately carried the coke to a building where it was quenched by water. From the quencher the coke was carried to the crushers where it was crushed to various sizes and then carried away to be sorted and piled.

They then inspected the by-product department of the plant. They traced the overhead mains which carry the tars and gases from the ovens through a series of separations. They learned that all the city gas of St. Paul comes from this plant. The city gas is the rich gas. The so-called lean gas is burned in the coke ovens.

Benzol is one of the chief by-products. This organic liquid is used commercially as a solvent and as a fuel. It is being used extensively as a constituent of gasoline.

The NH_3 recovery plant was also of great importance to the party. The gases are washed with a dilute solution of H_2SO_4, the ammonia being collected as $(NH_4)_2SO_4$, which is separated from the solution by centrifuging. This sale is used extensively as a fertilizer.

Coal tar is the wonder of the age. From it we get synthetic dyes, foodstuffs, flavoring extracts, and the deadliest poison. And, to the wonder of some, they learned that the pitchy black mass left after the separation of the other by-products was the same coal tar. The tar produced at this plant is shipped elsewhere for refining.

After visiting the different departments and the laboratory, the pilgrims proceeded to the top of the ovens where they watched the process of discharging and charging the ovens from beginning to end.

M. F. Wichman, E. E. '22, was married on October 7 to Helen Holden, of St. Paul. He is in the employ of the Northwestern Bell Telephone Co.,

ARCHITECTS

JANUARY DESIGN AWARDS

The first preliminary essquisse-essquisse in the national competition for the Paris Prize annually offered by the American Society of Beaux-Arts Architects took place early in January. The problem called for the design of "An Orchestra Pavilion in a Park." In the local judgment on the designs produced by the Juniors and Seniors here, Mentions were awarded I. Woodner Silverman, C. H. Hinman and W. A. Backstrom. In the New York judgment, by way of variety, First Mention, placed third, was awarded A. Strom; while Wallace Bousall received a Second Mention.

Two recent etchings by Professor S. Chatwood Burton are now on exhibition in the Chicago Art Institute. Both depict scenes sketched by Professor Burton during his late year's sojourn in Spain. One, particularly striking in composition, is a bit of old Cuenca, where the crooked balconied Spanish houses crowd and lean beyond the brink of a beetling precipice in most precarious- and picturesque-wise.

CURRENT ART

The University is to be congratulated upon having obtained for exhibition in the Architectural Department some of the more recent paintings of Eddie Holien, the celebrated child-artist.

Doubtless it is presumptuous to criticize the work of a recognized master (however young) but we can but feel that there is something in the chromatic nuances—something in the ophthalmic triads, as it were; or, better, in the synthetic superposition and juxtaposition of these triads and their various crescendos, diminuendos, and innuendos, as it were; or, better, in the ostensibly hypochondriac neoterics in the matter of color—but of course we can not afford to be too glib in our criticism of the work of an avowed master.

Mr. Holien's morceaux are on exhibition from 6:30 A. M. to 12:00 P. M. daily in the Senior Drafting Room. On Tuesdays and Fridays the artist is usually present between the hours of one forty-five and a quarter of two, to meet those of his admirers who care to present themselves. Password of admittance: Fools rush in where angels fear to tread.

CARLYLE SCOTT'S 'MUSICAL ARCHITECTS'

There is a famous old ballad which terminates in this quatrain:

I love the twitter of the horse,
The giggle of the cow—
I think I'll take some aspirin
I'm feeling dizzy now.

which quatrain, some are inclined to think, might be taken to heart by some of the drafting room twitterers. Others, the twitterers included, think that music, even in its less classical forms, is an inspiration to better architecture.

stretch for design, there is something distinctly rational in singing *When the Roll Is Called Up Yonder I'll Be There*. And the mental strain consequent upon the running of a large dark-black graded wash is considerably relieved by the whistling, in calliope-like blasts, of some such nervous tune as Beethoven's *Turkish March* or the *Cinquantine*. And who can doubt the refining influence upon the profile of an Irish Renaissance entablature of that close—close, but ventilated—harmony which occasionally is wafted from the Sophomore Drafting Room? "How beautiful ARE the feet," carols one toiler, as he strives to wedge an eighty foot church on a seventy-five foot lot; while another sets the smoke-laden atmosphere into vibration with the dulcet strains of *The Young Prince and the Young Princess*, (à la *If*) from *Schéhérazadé*. Now and then some bold spirit makes an attempt at starting *Row, Row, Row Your Boat*, or *Three Blind Mice*, but harmonious ensemble effects are disdained as passé by this group of moderns. Stravinsky-like indepeudence of key, melody, and tempo on the part of each performer is the only thing recent enough to be compatible with our advanced outlook upon the arts.

RETURN OF THE NATIVE

"I found the East very picturesque," reported Donald T. Graf in the annual travelogue of the Moorman Prize winner before the Architectural Society, substantiating his report by means of a casual reference to the streets of Boston's Little Italy "festooned with red underwear and other laundry." Chicago, Boston, Cambridge, Salem, New Haven, New York, Philadelphia and Washington were on his itinerary; and the more important architectural schools, as well as several architectural offices of the first rank, were visited.

The travelogue, given in Mr. Graf's inimitably inimitable fashion, bore witness to the fact that the architectural traveler finds inspiration not only in the strict wood-brick-and-stone product of the art—important as that inspiration may be—but also in the spirit and atmosphere that enwraps it: the dreamy, self-forgetful charm of old Salem; the quaintness of lettering and sentiment found in the epitaphs in Copp's Hill Burying-Ground; the electric thrill pervading the Harvard "yard" on the day of the Yale-Harvard game; or, even, the comparative identity of cities—all these things incapable of being photographed or brought home in a sketch pad, nevertheless leave valuable impressions on the architectural intellect.

Mr. Graf spent a day with Ralph Hammett in Boston and Cambridge; the two, judging by the travelogue, dividing their enthusiasm equally between epitaphs and the afore-mentioned Yale-Harvard game. In Philadelphia he saw W. E. Willner, our late lamented president, who is now adding new stars to his already cumbersome crown through excellence of postgraduate work done in the University of Pennsylvania.

CIVILS

Mr. A. C. Godward, at the meeting of the A. S. C. E., January 25, gave the civils what might be called a short course in Municipal Engineering.

Mr. Frank W. Roos expounded on the merits of the "Ancient and Honorable Order of the Plumb-Bob" in his own way.

The athletic and necking situation was discussed at great length and remarkable clearness by Mr. Lloyd Mitchell.

Mr. Al Greene rendered some poems and Mr. C. S. Nyvall sang.

Professor Frederick Bass reported on the National A. S. C. E. convention at New York, which he attended.

Professor Frederick Bass entertained the officers of the Student Chapter of the A. S. C. E. at his home, Thursday evening, January 11. Plans for the coming meeting of the year were discussed and several recommendations were made for the chapter to vote upon at its next meeting.

The principal matter will be question of raising the dues. A program of education of underclassmen in the ideals and character of the society will be started immediately.

Senior civils, after completing the course in Waterology, held a competitive display of hydrographs. These drawings displayed the relative merits of different inks on co-ordinate paper. Art Zimmerman got "Credit" on his and bought freely. Geo. "Goosmer" got "Cash" and Al Johnson got "Cash Recommended." The rest of the bunch got hell from the janitor for mussing up the room. The senior room is No. 227, just alongside of the "Story-Telling Room." Several remarkable signs and also a famous collection of pictures is contained in this room. One of the most valuable prints was stolen recently and rumor has it that it is now the main motive of the decoration of one of the seniors' apartments. Deep and awful are the arguments in this room, as should they be in so hallowed a room. F'instance, Prof. Bass gave a very short talk on the scheduling of hockey games in the afternoon. The class sustained his points and went down on record as being heartily in favor of having them played in the morning, so that those not desiring to see them can sleep through until 1:30. This question will probably be voted on at the next A. S. C. E. meeting.

Radio in Train Operation

Some months ago, it was definitely proven that radio broadcasts and messages could be caught by a receiving set on a moving train. It remained, however, to be proven whether radio could be applied to railroading to increase the efficiency in train operation and dispatching. This was settled in October by tests carried out upon the Broadway Limited of the Pennsylvania System on its run from New York to Chicago.

Heretofore, outside aerials have been used exclusively in such experiments, but in this case a small and very compact instrument upon a table in the train was used, the aerial being only eighteen inches square.

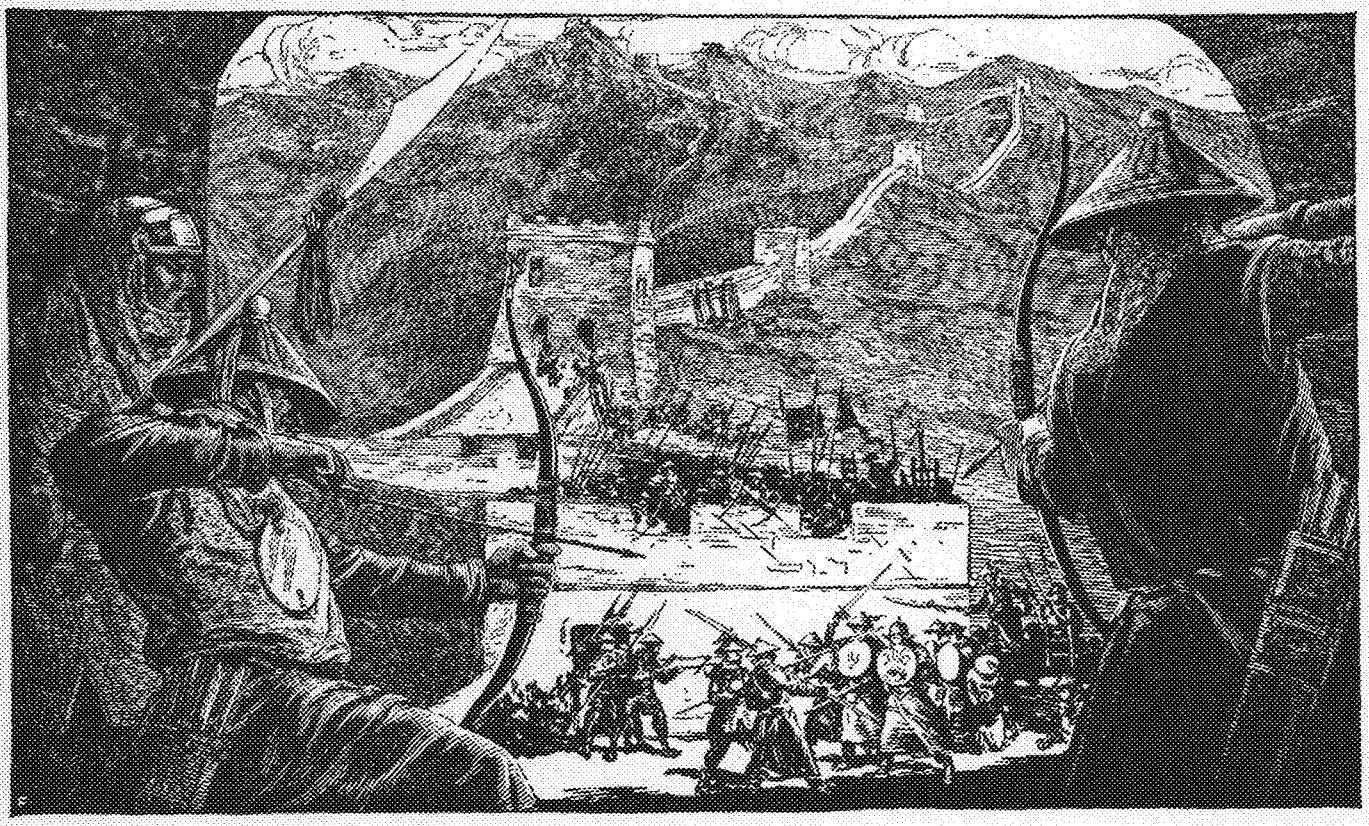
Broadcasts of the regular stations were received even while the train was passing over the electrified part of the line around Philadelphia. This is remarkable and the high efficiency is even further demonstrated by the fact that at all times the waves came through the steel coaches.

This performance at once suggests the possibility of sending all important messages, train directions and, on long freight trains, communicating between locomotive and the rear of the train, by means of radio.

Dr. Harvey C. Hayes, Physicist of the Naval Engineering Station at Annapolis, has designed a new apparatus which is a radio sounding device for registering ocean depths. The device has been tried out by the navy and has proved a complete success, registering automatically and instantly depths from 2,400 to 28,000 feet in the experiment. Sound from an oscillator, installed in the ship, is projected against the ocean bottom and rebounds, being received by sensitive apparatus. The elapsed time is automatically measured. This invention will revolutionize the charting of ocean beds and is a big step forward over the old plumb line.

Karl A. E. Berg, '20, engineer and scout on oil exploration work in Montana and Wyoming for the Northern Pacific Railway, was back the first of the year "scouting" about the campus again. He is now located at 520 Securities Bldg., Billings, Mont.

Professor J. J. Flather, head of the mechanical engineering department, has recently become a member of the Power Test Code Committee of the American Society of Mechanical Engineers.



The Great Wall of China

To stop the inroads of the barbarians of Northern China, Chin Huang-Ti in 214 B.C. began building the Great Wall of China.

Brawn was nearly the only force at his command to accomplish this enormous task. He gathered together an army of 300,000 men and set them at laboriously hewing out the stone for the faces of the wall and gathering rubble to fill in the inside.

Generation after generation of Chinamen toiled on the structure. Another dynasty arose and continued the work. Even as they labored, they were often called upon to repulse the attack of some hostile horde. The Great Wall still stands, one of the most remarkable achievements of human strength and persistence.

The cost of time and labor was immaterial to the Chinese Emperor, Chin Huang-Ti, but to the modern road builder, contractor quarryman or miner, these two factors are of great importance.

Explosives have been one of the principal factors in reducing the stupendous production costs of bygone ages, but the necessity for eliminating waste has become so urgent that even dynamite, perhaps the greatest labor-saving invention of all history, must now be scientifically selected. It is possible to reduce blasting costs with Hercules Special No. 1 on work for which it is suited. This explosive contains about ⅓ more cartridges per case than ordinary dynamite and usually replaces 40% dynamite, cartridge for cartridge, at a saving of 25% or more in blasting costs.

Our booklets, "Volume vs Weight" and "Eliminating Waste in Blasting," tell why Hercules Special No. 1 and Special No. 2 are so economical. Write to our Advertising Department, 939 King Street, Wilmington, Delaware, for free copies of these booklets.

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ELECTRICALS

O. E. SEILER SPEAKS TO THE A. I. E. E.

"Where are we going?" asked Mr. O. E. Seiler, of the A. I. E. E.'s, at their first meeting of the quarter.

The meeting was preceded by a dinner at the Minnesota Union at 6 P. M.

Following the feed an excellent film on the starter-generator system of the Dodge car was shown. This film showed by a clever arrangement of diagrams and photographs every detail of current and magnetic flow in the complete action of the system.

The speaker of the evening, Mr. O. E. Seiler, is state manager of the Phoenix Life Insurance Co. Mr. Seiler's topic was one of vital interest. He impressed everyone with the fact that success is attained only by having a definite aim and purpose in life which is constantly pursued. Watching the crowds on Broadway as they thronged by him one day he asked himself the question where are they going? Then he asked himself where am I going? What is my purpose in life? This is a question every university man should ask himself. Is he going to school just to be going to school or is his school work a part of his aim of life?

Out of his class there will be two or three men who will be outstanding successes. The rest who attend the same classes hear the same lectures and get as good marks will fail to reach the top. This is because they are just going to school and thinking no farther than next week, they have no definite purpose for which they are constantly striving. Each class will probably produce only one Mayo or one Roosevelt. The secret of the success of these men is that by the strength of their will and the power of their personality they overcame any obstacles which lay between them and the attainment of their purpose.

In choosing an aim, aim high and stick to it. It is better to try for a million dollars and miss it than to try for five hundred and make it. The world will stand aside and help the man who has a definite purpose and knows he is going to attain it. On the street the loungers will always stand aside for the man who knows where he is going and knows he is going to get there.

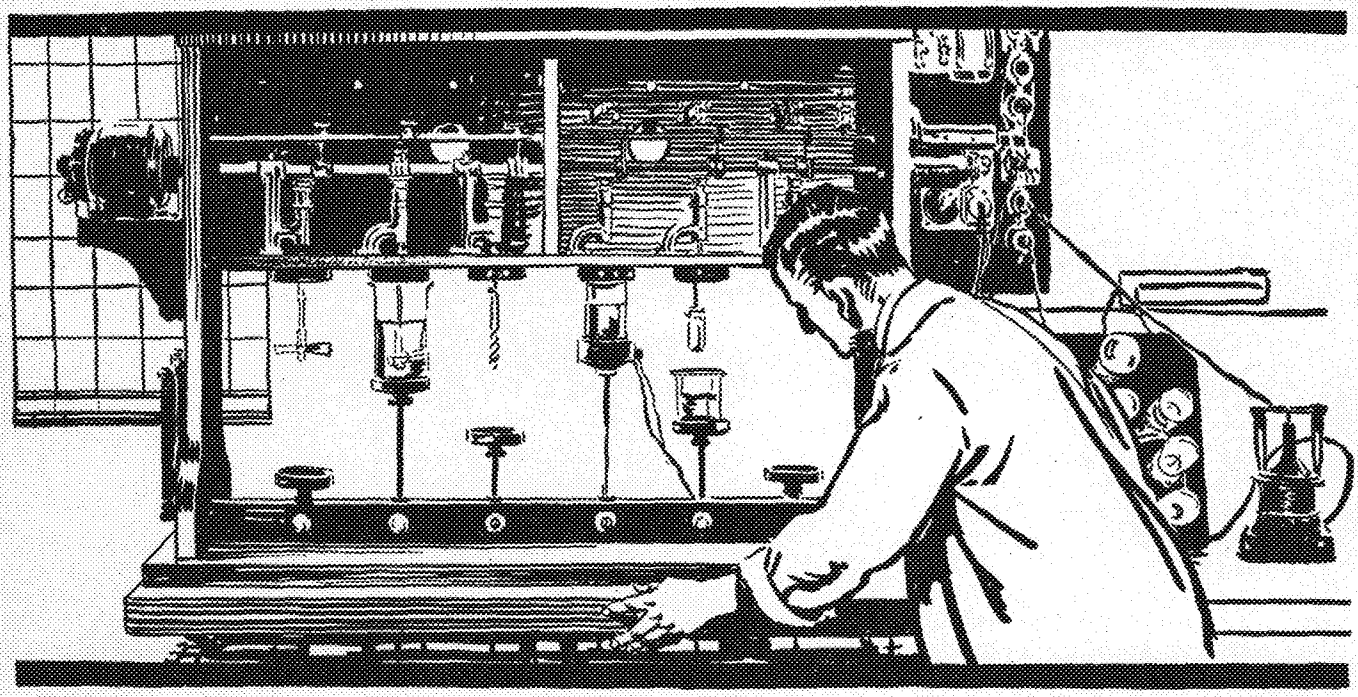
In conclusion he cited an incident that he observed one afternoon at the corner of Nicollet and Sixth. The sidewalks were thronged with people and the streets crowded with traffic. But heedless of the traffic the crowds pushed back and forth across the street, holding up the traffic. Then came the siren of the fire trucks. The crowds rushed back to the sidewalks and gave the trucks a clear path. They had a definite purpose and knew where they were going. In the same way the world will stand aside for the man who knows where he is going and knows he is going to get there.

Some of the members of the Senior class very vividly demonstrated the magnitude of the centrifugal force on the conductors of a motor armature, during a test recently. An old smooth core D. C. motor was being run above speed when one of the bands gave way, allowing the armature conductors to fly out. The conductors caught on the field poles and tore off the insulation. The incident very clearly showed the superiority of the more recent types of motors. With the conductors in slots there is very little chance that the conductors will come loose—the commutator being the weakest place. Many of the new motors operate at a normal speed of about the same magnitude as that at which this motor gave way.

A Shindig—whatever that may be—was staged by the Sophomore Engineers on Saturday, January 20, 1923, the action, which is said to have been very lively, taking place at the Maryland Hotel. The dance was greatly enjoyed by the seventy couples attending. The affair was chaperoned by the Rhetoric department et al.

R. A. Steffens, class of '22, of the Westinghouse Co., and F. Klass, class of '19, of the General Electric Co., have been explaining the propositions of their respective companies to interested members of the senior Electrical and Mechanical classes. Klass has taken the test course at General Electric and Steffens is at present taking a course at Westinghouse. They are here now arranging for interviews later with representatives who will be sent out from the main office. Present indications are that several of the present senior class will be taking a student course with one of these companies.

Prof. W. T. Ryan was elected president for the coming year at the meeting of the Minneapolis Engineers Club, Monday, January 15. Prof. Ryan has been active in the organization, being vice president last year. At the same meeting, Ray Sweet gave a general talk on radio, devoting considerable time to the answering of questions. Mr. Sweet is the manager of the WLAG broadcasting station.



Blazing Trails for Progress

Curiosity may have killed the well-known cat, but it has been underneath most of the hard-won developments that lastingly benefit mankind. Once in a great while, perhaps, accident has been the spark that has lighted the torch of achievement; but much more frequently—always, nearly—accomplishment, especially in the field of science and invention, has grown out of the insatiable curiosity that seems to be the heritage of us all. Mankind wants to know—and is slowly finding out. Curiosity, the complement of imagination, knows no appeasement.

This is, however, no essay on the vague subject of idle curiosity. There is a vast difference between that and the organized, untiring, well-planned activity which, as an integral part of Westinghouse organization, searches continually for the answers to problems which intelligent speculation sets up. This, if you please, is curiosity in its highest and most intensified form; and it is a fundamental thing in the Westinghouse operations.

Research, as we know it, is the guiding hand upon the purely creative activities of business. Constantly it brings to light new aspects of known laws, new visions of laws yet to be uncovered. But the search for these is not haphazard nor whimsical; it is organized and planned as carefully and thoroughly as any other business activity. Whether chemical, electrical, or physical, it is engineering; and it follows engineering methods and tradition.

Many great engineers have been wholly at a loss in this specialized activity. For research, in a sense, reverses the usual order. Its endeavor is to discover unknown laws in the known facts—a thing which is quite at variance with ordinary engineering practice. Yet there is a fine type of engineering mind which finds its great opportunity in this kind of work. And to that type of mind, and that type of man, research beckons with an unmistakable hand. It is engineering pioneering, it blazes trails for progress, to new triumphs, in a wilderness into whose outskirts man has scarcely penetrated.

TECHNO-LOG'S TRAVELOGUE

(Continued from page 8)

lengthened our strides down the winding trail. We passed a lone homesteader's cabin without a halt, while the half-breed members of his family stood and watched us out of sight. We found out afterwards that we were the first white people they had seen in six months, and we had shattered all precedents in northland etiquette when we failed to stop and talk. After traveling three days through woods of spruce and pine we finally pitched camp a mile from the nearest green bedding, so the first night we slept sans mattress, and the ground wasn't form-fit either.

Our stay at the lake was not a long one—only ten days—but it was filled with experience. The nights were bitter cold and as we doubled up our beds we thought of the great Greek philosopher who claims that alimony may be all right, but it doesn't keep you warm on a cold winter's night. The days were hot. We worked in shirt-sleeves with collars open wide, but when the sun went behind a cloud the air was strangely chilly.

Our steady company were the Indians. Wonderful specimens of stalwart manhood they were—not. I've often wondered where they found those romantic scenes they put on calendars, those beautiful, dark-skinned maidens paddling birch canoes in the moonlight—dazzling beauties, almost dressed. I know now—it's either New York or Chicago. The nearest comparison they have to any of the foothill products we saw was the off-season garment part of it. If you can see a dainty squaw of sixty-five clothed in a house apron, with her trifle one or two hundred and fifty pounds planted in front of her tepee, chewing tobacco and cleaning fish, you have the inspiring material for a snappy art-color advertising calendar. They could make good moccasins. Big, little, good, or bad, two dollars was the price. Being reservation Indians, they probably thought that since the white man made all the money he had lots of it. They hung around our camp and tried to be sociable for what there was in it. They were the dirtiest and laziest individuals we had ever seen. We had to put up with them, however, because we needed their dug-out in which to cross the lake.

About the Dug-out

Of all the deathly contrivances, I think the dug-out is grand champion. Cut and burned out of one solid log, just as it says in the books, and shaped like half a banana. It may be better than swimming, but it's no craft for a nervous man with wool underwear. Every time I thought of my insurance company while I rode in it I felt conscience-stricken. I suppose the Indian thought it would be worth two dollars to swim out after the thing in case a sudden wind struck us while we were crossing the lake.

Of course, our main purpose in assembling ourselves at a place so extremely distant from cones, movies, bathtubs, and other luxuries of life, was not sight-seeing alone. It might have been a search for a suitable place to turn the cook loose and leave him thus for a short time, at least protecting the eating world from his many sins. If there's any time when a man loses the delicateness of his appetite it is probably in the mountains, where he climbs fifteen or twenty miles a day and perhaps gets a little exercise on the side as we did. The same man that pulled me to the beauties of the sunrise at four in the morning, with the soft intonations of a coyote, was the fellow that put mud in the coffee, fried the potatoes in water to be sure they didn't burn, and then burned everything in sight except the dishes. You could kill a rabbit with one of his biscuits—and the whole rabbit family if he took it home to supper; and to make our love of cooks complete, he hid the raisins for his own use, and carried the last of the sugar around in a Bull Durham sack to await his own sweet consumption. We slowly robbed him of his job. We had fresh moose meat, and since Nature did a pretty good job when she made the moose, by frying it ourselves we subsisted without the biscuits.

Running the Line

It's not revealing too much of our secret to admit that we surveyed. It was the first treat of the kind this wild geography had undergone, and the variety of terrain that we had the pleasure of laying out included everything from Greenland to the equator. First we were running a line in muskeg, a foot or two deep, and fresh with the chill of half-melted frost and snow, then we were climbing some forty-five-degree hillside, with loose rocks clattering away under foot, and a twenty-foot vertical cliff to reward us when we reached the top. We were running a line, mind you, not taking a mountain stroll. There were times when the grade was so steep that the chainman behind would stretch to his fullest capacity to level the chain and then, without moving, hand the pin to the man in front. Sometimes it was poplar, second growth, that chopped at one stroke and was clear underfoot, while over the hill was a spruce thicket through which it took us all day to cut our half mile. It would have been easy to be careless, for who could check up on a survey that was as high as it was long? The tangle brush was the worst—two dozen reinforced rubber branches, of natural corkscrew shape, growing in two dozen inconceivable directions from a single root, and a new root every six inches. It took two chops to a branch, with more or less verbal exhortation for good measure, and if progress was too easy, the hill took on a new slope or we got off the picket line just to make it more interesting.

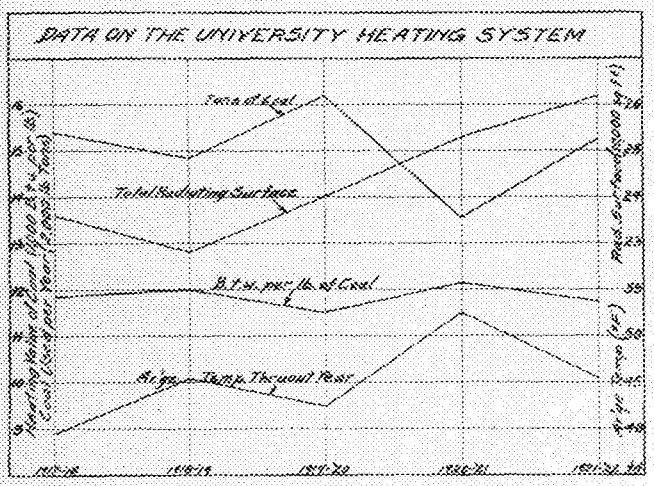
One day brought us to the most beautiful acreage of windfalls I ever hope to see. It was probably the product of a ground fire and a high wind, for only the bark was gone from the trees. There they lay, over a hundred feet long some of them, and piled in all directions to a depth of six or eight feet. There was nothing to do but survey over them, and we did. We traveled three hours without having the tripod on the ground. Of course, our line was as straight as the equator, but it was almost as imaginary.

Some details of our fun bear less description. It is with a sigh and a silent nod that we recall our first night out—alone. It was on a beautiful hill-top, the wind was traveling gently southward at about thirty miles per, and the beautiful snow lay piled about us in graceful three-foot drifts. We were coatless, blanketless, and without food, but we stayed there all night. We live to learn, they say.

It would take a book to tell the story as it should be told. The work was finally finished and the guides set out to find the roaming pack-horses. The Indians gathered up the pieces and bid us a fond farewell. The trails had dried a little and it seemed

(Continued on page 28)

MECHANICALS



The above curves are plotted from data furnished by the Department of Buildings and Grounds of the University of Minnesota. They apply to the Main Campus only.

During the fiscal years 1917-18 and 1918-19, the coal used per year has been estimated for the full twelve months of each year because the heating plant was in operation for a little less than a year in each case. However, the figures given are correct for the rate per year of coal consumption.

The total radiating surface given includes direct (radiators, etc.) and indirect (coils in ventilating fans, kitchen and laundry apparatus, etc.) surfaces. The equivalent indirect radiating surface amounts to about 23 per cent of the total radiating surface. These figures do not include what is necessary for hot water heating.

In connection with this information, it is interesting to note the power rating of the University plants, which is as follows:

Plant	Boiler H. P.	Engine H. P.
Main heating plant	2800	negligible
E. E. Building power plant...	365	375

A. S. M. E. NEWS.

The local student section of the American Society of Mechanical Engineers held its regular monthly meeting on January 20, 1923. Room 136, M. E., was crowded to capacity, many non-members being present at the meeting to hear Professor J. H. Rowen's talk on the Theory of Gravitation.

Professor Rowen, who has spent a great deal of time on the study of gravitation, its laws and effects, gave a very interesting account of his investigations and computations.

President Olmstead announced that the date for the annual banquet had been set at February 17, 1923. Plans are under way to make this banquet surpass, in every way, those given in previous years.

A. S. M. E. SCHOLARSHIP.

The attention of all mechanical engineering students is called to the fact that each year, under authority of the governing bodies of Columbia University, the American Society of Mechanical Engineers has been extended the privilege of naming the recipient of a scholarship in Mechanical Engineering.

The scholarship is awarded for graduate study at Columbia University to a student having had three years of study at a recognized technical institution, or to one holding a Bachelor of Science degree. The scholarship amounts to about $350, to cover tuition fees, which vary, according to courses taken, from $340 to $360.

Further information may be obtained by consulting the senior bulletin board in the Mechanical Engineering Building, or by communicating with either the National Secretary of the A. S. M. E. or the Secretary of Columbia University.

Henry C. Forbes, E. E. '22, has spent the summer in research work in the radio laboratory of the Bureau of Standards at Washington, D. C. He expects to return to Minnesota to take up graduate work.

TECHNO-LOG'S TRAVELOGUE

(Continued from page 26)

but a short trip to Hudson's Hope, whence we had departed two weeks before. Now that the trail was old, we were anxious to get back and wash up. We had solemnly pledged to let live both beard and mustache until the trip was over, and our chins were growing heavy with unneeded winter furs. Thus far mosquitoes had left us alone, but we had heard their history and were not anxious for an encounter.

The down-river trip was scheduled to be short and sweet—in fact, while we had taken nine days to come up-river, we were but twenty actual hours on the return. The sun had begun to do its work in the mountains, and the river was rising rapidly. The seven-mile current we had bucked coming up had increased to twelve, and the water was filled with logs and debris picked up by the flood waters. It was a wonderful place to drown a cook but now that relief was so near we let him live. In spite of our speed, however, we were not in time to avoid the onslaught of man's most modern enemy, the royal squadron of flying cannibals.

The Mosquitoes

It was our first and only night on shore going down, and we were sorry in a way, because we knew that the days of wild adventure were coming to an end. I say that we were sorry in a way, but our sorrow was not complete, for the mosquitoes had come at last. Such a mist of whining, piercing, fighting insects I never want to see again. They were drunk with thirst for blood, had no fear, and rode around in high-power monoplanes that had all ranges of speed. There was no escape. Whenever one made a landing he got a meal, and this was a banquet night. The various confident members of our party uncorked their evil smelling protective potions and unfurled their elaborate sleeping nets. The onrushing army laughed the more. They bathed in the ointments and citronella with evident delight and played hide-and-seek in the mosquito bar. They bored holes in the blankets, bit chunks out of the shoes, went swimming in the coffee and got long-time leases on the butter. It was a night of long and watchful waiting and listening—listening for the fearsome whine and the more fatal silence that followed—while you awaited the signal to his landing place. By morning they had eaten and drunk their fill, and crawled away under the leaves and into the grass to sleep. It was a weary crew that blinked at each other across the campfire breakfast.

An Interesting Experience

No matter where you go, or how hard the going is, you cannot get away from the things that are beautiful in nature, and the farther you are from the hurry and importance of a business world, the truer are the hearts you find. It was on the same night that we kept our all-night vigil with the mosquitoes that an incident occurred which alone would have made the trip worth while. We were making our landing preparatory to building camp, when from across the river came the long piercing cry of a wild animal in distress. We cut the motor-boat loose and started across the river. What looked like a bear cub was running up the beach and crying in a manner that made us know, even in our clumsy ignorance, that it was in trouble. The distance was deceiving, for as we came closer to shore the animal seemed larger than a bear, and when we touched

old, came running toward us in its awkward, uneven fashion. Suddenly it stopped and stood rigid, staring up at us with wide, wondering eyes. One of the men ran forward and picked it up in his arms. It struggled feebly as we put it in the boat, and then was quiet. It was a great find, and we were anxious to get back and show the rest of the party our catch, but the boatman was slow in shoving off.

At last an old hunter spoke up and reminded us that the mother might be somewhere about. We had not thought of that, nor had it occurred to us that a week-old calf without a mother cannot live long. Rather shamed, we climbed out and began to look for tracks. We found them upstream but a short way, and the story was too plain to be mistaken. A cow with twins had come down from the hills to cross the river, but as she took to the water, one twin lagged behind and the mother swam over with only one. We crossed over to the camp and there our story was confirmed, for we could see the tracks, both large and small, where the animals had left the water. We didn't know what to do. It was useless to hunt for the cow. Of all cautious creatures, a moose is hardest to approach, and they can detect the approach of a man a mile off. So we decided to turn the calf loose and trust that she would wander to where the cow could find her.

We fed the beast by letting milk run down one of our fingers and then turned it loose, but it would not leave. Far into the night we could hear it bleating in the brush, and with dawn it came wandering weakly back into the camp, its cry now only a feeble, plaintive whine, and its eyes half shut. The men were old and hardened. Some of them had spent their lives fighting cold and hardship, but when they looked at the babe without a mother they forgot to laugh and found occasion to fuss with a packstrap or poke at the fire. Breakfast was a dismal failure. Everyone was too tired to talk and most of us were gazing moodily into the fire. Suddenly one of the men let out a muffled exclamation and then motioned for us to be still. We heard a commotion on the side of the hill and before we could ask a question a large cow moose broke through the underbrush not twenty feet away. The men were stupefied. The cow was so close we could have thrown a dish and hit it, but no one moved. She didn't seem even to see us. With a cry the calf sprang toward her and the two of them turned into the brush. We watched them climb the hill, until at last they disappeared over the top. I don't know how long we sat there, but not a word was spoken for a long time. I glanced from face to face around the circle, and I could see that everyone had been touched by what he had seen. There were tears in the old man's eyes as he coughed noisily and went down to the boat.

It was a powerful lesson to all of us, for it gave us just a glimpse of that which lies behind the whole scheme of things, and I realized that after all, we had seen but little. We had come out into the frontier of civilization with our knowledge and conceit to take our due from nature's resources, and had come away humbled by the love and courage of a dumb animal. Some day we are going back. The people need electricity, churches, schools, and sanitation. They need more attractive barber shops and better examples of living. They need young blood with modern ideas; and they don't know half the latest dance steps.

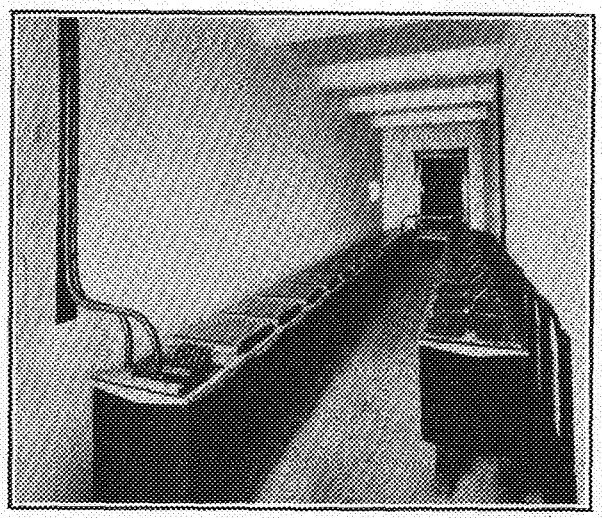
USES OF STORAGE BATTERY

(Continued from page 9)

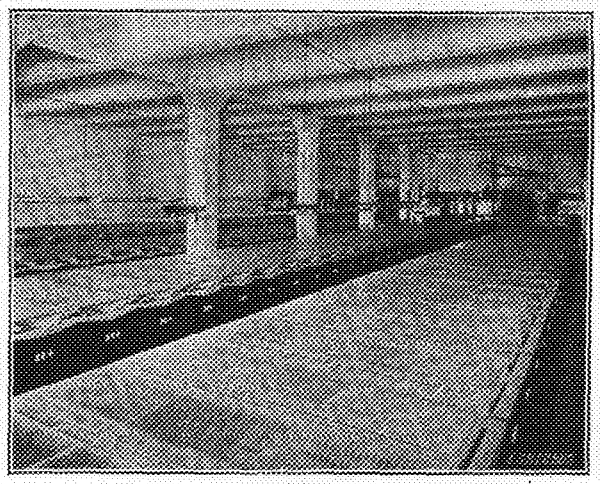
enough to light 103,000 25-watt lamps for one hour. The capacity of the Chicago batteries is approximately ten times that figure, and those in New York have a capacity several times greater than those in Chicago. Cells of the largest type weigh around four tons each, and their capacity is 50 per cent greater than the combined capacity of the three Minneapolis batteries.

Used at Interlocking Stations

Railroads are replacing primary cells in signal operation. Their cost is excessive, particularly when the rates of discharge are intermittent and high. To get away from this in the block system, a storage battery, located at each signal, is charged from a vibratory rectifier which is connected to an alternating current line running along the right-of-way. The rectifier furnishes the average current required, and the storage battery acts as a reservoir and supplies peak loads and emergency reserve for the protection of signal operation in case of power failure. Interlocking plants also use storage batteries. The Great Northern plant at Carlton is one of the newest and finest examples in this territory. Emergency power for bridges is another railroad demand. The law is, of course, the water has the right-of-way since it was there first, and a railroad operating a bridge must have it out of the way to accommodate navigation.



Constant potential requirements constitute the third use. None is more important than the telephone, and common battery exchanges could not be run efficiently without storage batteries. Since they are used directly in the talking circuit, absolutely constant potential is necessary, any variation



One of the three 150-cell 07-plate batteries of the Minneapolis General Electric Co.

naturally affecting quality of service. Negligible internal resistance is another requirement fulfilled by the storage battery; any appreciable amount would result in serious cross-talk. The usual size of telephone batteries is shown by a recent installation of the Tri-State Telephone & Telegraph Company at its St. Paul Garfield exchange. It is sufficient to accommodate a 30 per cent increase, and has a capacity of 2,400 ampere hours. The battery is composed of thirty-two cells, each weighing approximately 1,700 pounds, or a total of twenty-two tons. This is by no means exceptional.

Radio Uses Batteries

The importance of radio is being impressed more forcibly upon our minds each day, and the storage battery, with its constant potential, is an essential part of every large outfit. Operation of the tubes depends upon constant voltage, and the necessary current is beyond that of the primary cell. Army and battleship radios constitute an important part of the national defense.

Miscellaneous uses include fire and burglar alarms, police telegraphs, laboratory service, and farm plant installations. The electrical and physical laboratories at the University are excellent examples of this field. Although farm plants may seem to be of no importance, it is a significant fact that during 1923 a well known storage battery manufacturing company will furnish a single concern with about one-half million cells for this purpose.

TECHNICALITIES

BUT I DOUBT IT.

When a pair of red lips are upturned to your own
With no one to gossip about it,
Do you pray for endurance to let them alone?
Well—maybe you do—BUT I DOUBT IT.

When a shy little hand you're permitted to seize
With a velvety softness about it,
Do you think you could drop it with never a squeeze?
Well—maybe you could—BUT I DOUBT IT.

When a tapering waist is in reach of your arm
With a wonderful roundness about it,
Do you argue the point 'twixt the good and the harm?
Well—maybe you do—BUT I DOUBT IT.

"Why are you so small?"
"You know I was raised on condensed milk and short cake."

Prof. Zeleny—"Give Newton's law of motion."
Track Hound—"Every little movement has a meaning all its own."

Superstitious people claim that death is sure to follow the howling of a dog, but it all depends upon how good a shot you get at the dog.

Frosh—"Doctor, will you give me something for my head?"
Doctor—"My dear boy, I wouldn't take it as a gift."

Uncle—"Only fools are certain, Tommy, wise men hesitate."
Tommy—"Are you sure, Uncle?"
Uncle—"Yes, my boy, certain of it."

She—"My face is my fortune."
He—"How long have you been broke?"

She: "Did you meet any Stage Robbers while you were out west."
He: "Yes, I took a couple of chorus girls out for dinner."
—Columbia Jester.

Sunday School Teacher: "What became of the swine that had the evil spirit cast into them?"
Sonny: "They made them into deviled ham."

"Where did you get that quaint old medal?"
"Oh, that's an old heirloom. My grandfather won it in an oratorical contest."
"Indeed. Sort of a hot-heirloom, isn't it?" —Life.

Mrs. U. S.: "And poor Harry was killed by a revolving crane."
Englishwoman: "My word! What fierce birds you have in America."
—Cornell Widow.

Mrs. Wiggs: "Yes, sir, I always goes to church when you preaches."
Vicar (Flattered): "I'm glad to hear that, but why not every Sunday?"
Mrs. Wiggs: "I'm always sure of getting a good seat when you preaches, sir."

Soph: "I suppose your father will be all unstrung when he hears about your exams."
Frosh: "No, I wired him last night."

We claim that Wm. J. Bryan is all wrong; why just go to any first-class zoo and you can see any number of illustrations of Evolution. No doubt the elephant was the original design for a fire hose, and how about a pelican having a wonderful build for chewing tobacco? And then no doubt the kangaroo is nature's idea of a safe pedestrian.

With many auto owners
Charity's a gift,
They're always waiting round to give
The working girls a lift.

Prof.—Why aren't you taking notes?
Stude—I don't have to; I have my grandfather's.

"Isn't there some fable about the ass disguising himself with a lion skin?"
"Yes, but now the colleges do the trick with a sheepskin."

"A motor truck smashed into the baby carriage, and knocked it to smithereens, mum."
"Heavens, is the baby killed?"
"You're lucky, mum, he was kidnaped just five minutes before."

Ship's Officer: "Oh, there goes eight bells. Excuse me, it's my watch below."
Old Lady: "Gracious, fancy your watch striking as loud as that!"

Irate Professor: Young man, do you know anything about this course?
Young Man: A little, sir. What would you like to know?
—Stanford Chaparral.

Mr. Zelner (in the middle of a joke): Have I ever told the class this one before?
Class (in chorus): Yes.
Mr. Zelner (proceeding): Good, you will probably understand it this time.

What did you get in Chemistry?
A 14 cent refund.

THE KIND OF OIL.

Mother: Richard writes that he has been burning the midnight oil every night for a week.
Father: Yes, he'll have the old bus worn out if he keeps on.

"Jack and Emily are going to be married."
"Emily! I thought she was one of those modern girls that don't believe in marriage."
"So did Jack."—Harvard Lampoon.

John Q. Jones was an optimist. His favorite expression was: "Oh, it might have been worse." The town grew tired of it. One day they thought they had him. As he entered the store in the morning they called to him: "Here's something that can't be worse. Last night Bill Smith got back unexpectedly from a trip and found Sam Olson with his wife. Bill shot his wife, shot Sam, and then shot himself."
John grinned. "Sure, it might have been worse. If he'd of got home a day earlier he'd of shot me."

ALUMNI

(Continued from page 15)

struction of forty miles of highway, and fourteen steel bridges.

Sven Vaule, M. E. '22, is designing for the Pillsbury Milling Co., in Minneapolis.

Freeman Kaplan, Arch. '18, is a member of the firm of Liebenberg, Kaplan & Martin, Architects, 617 McKnight Building, Minneapolis.

George Dahl, Arch. '20, having received his Master degree from Harvard University and spent some time traveling on the continent, is studying in a large European school.

P. P. Bisek, E. E. '14, is assistant superintendent at the United States Reclamation Service, Power Plant No. 1, at Williston, North Dakota.

John Dawson, Arch. '22, is teaching at Minnesota, after a year teaching at Kansas, and some time spent in the office of Hewitt and Brown, architects, Minneapolis.

Walter A. Grettum, E. E. '22, is working as draftsman on state highway work, and living in Minneapolis.

H. J. Frost, E. E. '22, is employed as an engineer on dam construction work near Winton, Minn.

John M. Downie, E. E. '22, who showed remarkable histrionic talent in the Arabs Dramatic Club's play last spring, is testing for the General Electric Company, at Schenectady, N. Y.

O. E. Dunnum, E. E. '22, is working for the Ideal Electric Company, a concern manufacturing electrical machinery at Mansfield, Ohio.

Richard E. Carlson, E. E. '22, is in the engineering department of the Western Electric Company, at Cicero, Ill.

G. H. Bockus, E. E. '22, is with the Anderson-Bearesh Co., 430 Second Ave. So., Minneapolis.

Earl Bjonerud, John M. Downie, and Carl H. Linhoff, all E. E. '22, have begun their careers with the General Electric Co., at Schenectady, New York.

Bertin A. Bisbee, E. E. '22, is working in the engineering department of the St. Paul Gas Light Company.

D. H. Aultfather, R. E. Carlson, H. F. Drost, J. E. King, H. G. Plank, J. E. Sorensen, and A. W. Wilson, all E. E. '22, are with the Western Electric Co., in the central office engineering division, at Chicago.

Oscar Schermer, Chemistry '21, is chief chemist for the Manufacturers Chemical Co., St. Paul Park, Minn.

C. Philip Carlson, E. E. '21, is teaching in the Eveleth High School.

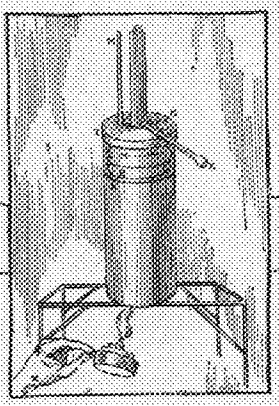
After a year of exploration work in Cuba, R. G. Butler, Mines '21, has returned to this country, and is instructor in mining at the University of Alabama this year.

Mr. and Mrs. R. E. Westberg, E. E. '20, announce the arrival of a daughter, Marjorie Jean, on July 12. They are living at 4515 Sixth Ave. N. E., Seattle, Wash.

The September issue of the National Electragist contained an article by A. P. Peterson, E. E. '19, on "The Difference Between Knowing and Not Knowing in Home Wiring Work." Mr. Peterson is secretary of the Minnesota Association of Electragists, an organization of electrical contractors and dealers.

J. K. Wong, E. E. '16, has returned to China, where he is the chief engineer of the Canton Arsenal, Canton.

DENIS PAPIN'S



STEAM CYLINDER

They Weighed Air— *and* Charles II Laughed

SAMUEL PEPYS says in his diary that Charles II, for all his interest in the Royal Society, laughed uproariously at its members "for spending their time only in weighing of air and doing nothing else since they sat."

This helps to explain why Charles has come down to us as the "merry monarch."

The Royal Society was engaged in important research. It was trying to substitute facts for the meaningless phrase "nature abhors a vacuum," which had long served to explain why water rushes into a syringe—the commonest form of pump—when the piston is pulled out.

Denis Papin had as much to do as anyone with these laughable activities of the Royal Society. Papin turned up in London one day with a cylinder in which a piston could slide. He boiled water in the cylinder. The steam generated pushed the piston out. When the flame was removed, the steam condensed. A vacuum was formed and the weight of the outer air forced the unresisting piston in.

Out of these researches eventually came the steam engine.

London talked of the scandalous life that King Charles led, and paid scant attention to such physicists as Papin, whose work did so much to change the whole character of industry.

The study of air and air pumps has been continued in spite of Charles's laughter. In the General Electric Company's Research Laboratories, for instance, pumps have been developed which will exhaust all but the last ten-billionth of an atmosphere in a vessel.

This achievement marks the beginning of a new kind of chemistry—a chemistry that concerns itself with the effect of forces on matter in the absence of air, a chemistry that has already enriched the world with invaluable improvements in illumination, radio communication, and roentgenology.

General Electric

General Office Company *Schenectady, N.Y.*

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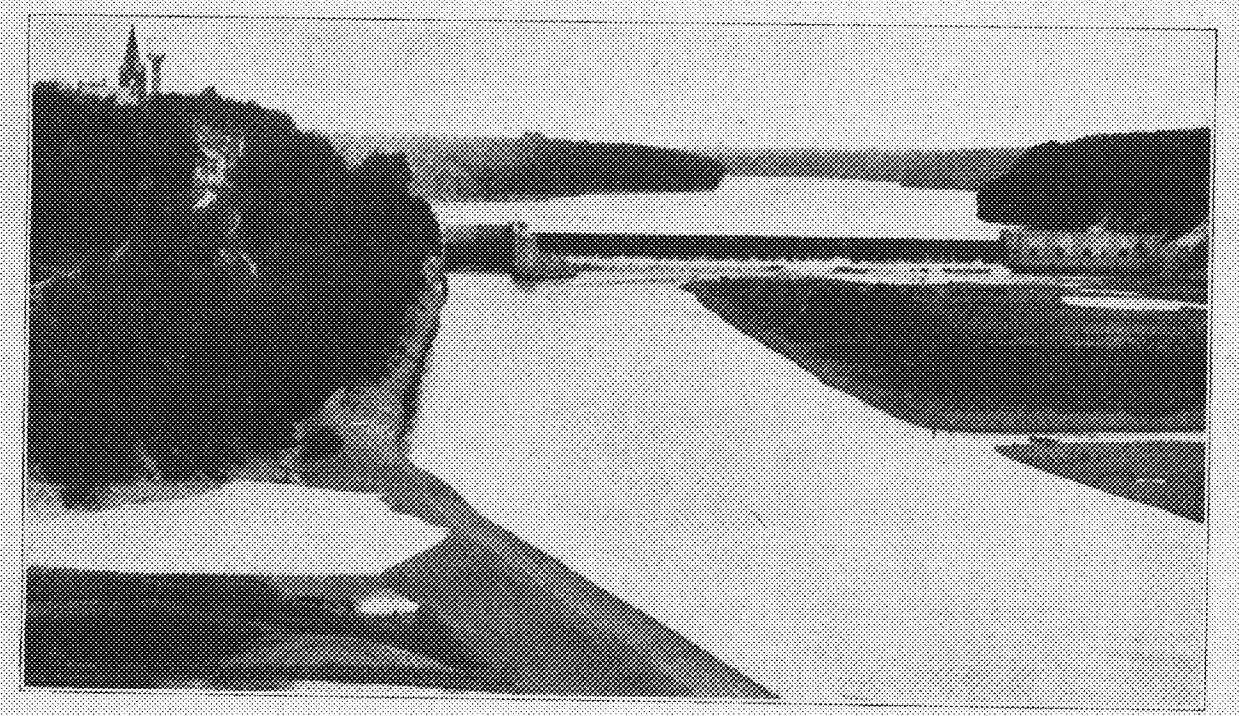
MINNESOTA TECHNO-LOG



MARCH 1923

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VOL. III UNIVERSITY OF MINNESOTA NO. 5

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Detroit, Michigan
ALBERT F. KAHN, Architect
Drawn by Hugh Ferriss

"In Terms of the Colossal"

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Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

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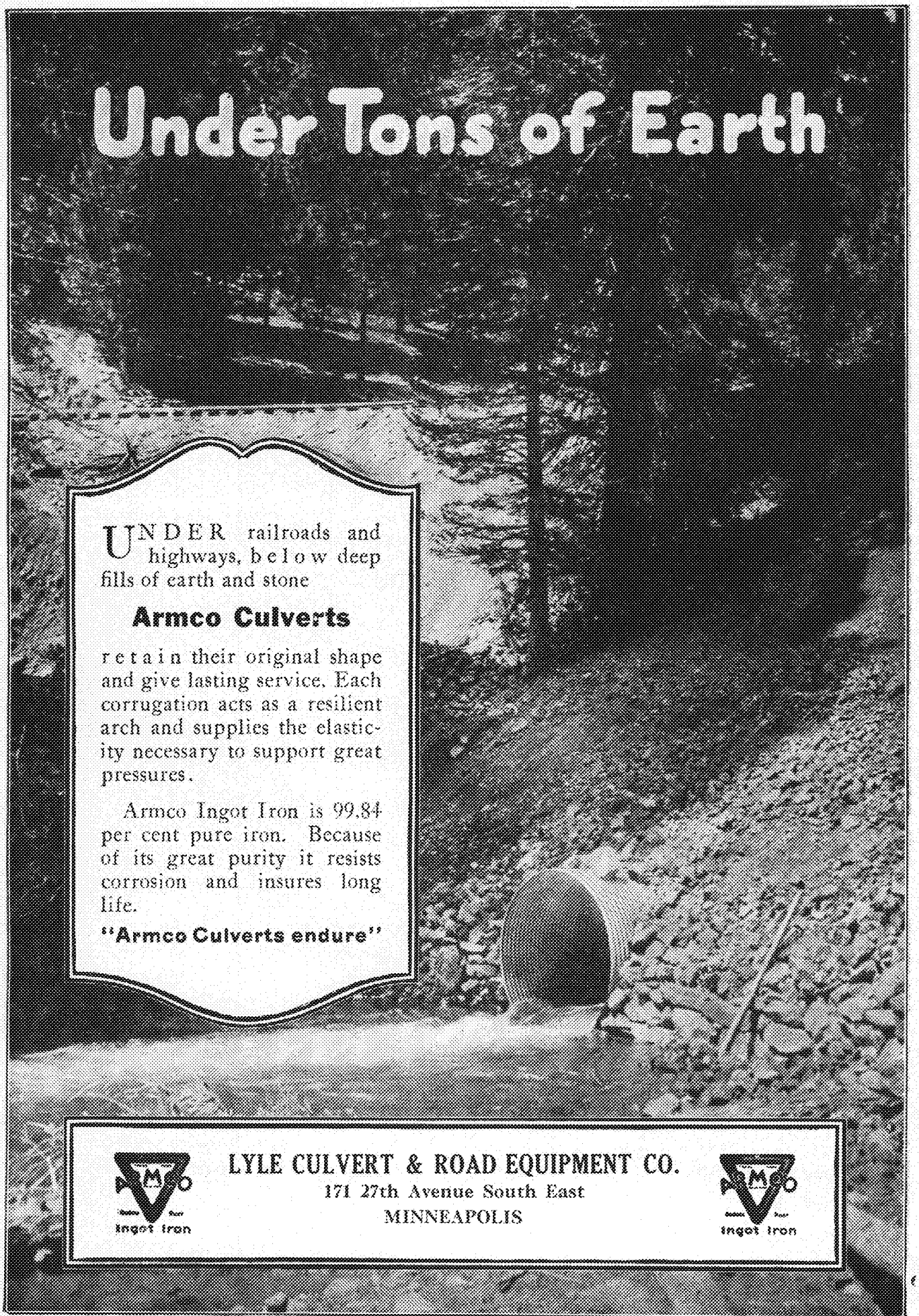
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Armco Culverts
retain their original shape and give lasting service. Each corrugation acts as a resilient arch and supplies the elasticity necessary to support great pressures.
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University of Minnesota

VOLUME III | MARCH, 1923 | NUMBER 5

TWENTY-FIVE YEARS FROM NOW?

Alcohol and Fuel Gas To Be Principal Fuels of the Future

By G. L. Tuve

The subject of this article is a somewhat speculative one, but the author has endeavored to make only such statements as are supported by good authority. All references have been omitted but will gladly be supplied to anyone interested.

HOW many years of "experience" will the present students in engineering have to their credit when one of them shall decide to favor one of his "globe-trotting" classmates with a "letter from home," and shall write, among other things, something like this:

Dear Bill: I was just thinking of how we used to wonder, when we were in school together, if it were possible that engineering would make as many changes in our everyday way of living in the years just ahead as it had in the years which had elapsed since we first began to notice things. I guess you haven't been back to the States since you left here the year after we graduated, and you no doubt remember things as they were then. It just occurred to me yesterday as I paid my gas bill that you might be interested to hear just how much different things back home are now than they were when we were at Minnesota together. You see we use gas for heating in our new bungalow. In fact it hardly pays to use anything else since the new high pressure gas line came in from the Illinois coal fields. Remember the job you had during your Sophomore year taking care of a furnace? All that job would amount to now is lighting the gas pilot in the fall and turning it out in the spring? Of course some people burn oil and a few burn carbonized coal, but the burning of raw soft coal is prohibited by city ordinance and we've forgotten what "smoke" looks like. We don't use electricity for house heating to any great extent here in our city, but some communities, where water power is available, use more electricity than gas.

"I'm still driving a gasoline automobile. In fact in the passenger car field the gasoline motor still has the lead. The newer fuel oil motors aren't quite as convenient but as they cost a good deal less to run the gasoline motor has practically disappeared from the motor truck. Of course our 'gasoline' is largely a mixture of the shale oil product with alcohol and benzol, while our fuel oil comes either from shale oil or coal. . . ."

One might go on indefinitely with a "story" like this but let us come back to 1923 and examine a few of the indications regarding the future of our fuel supply before someone tells us that such a "story"

Since the beginning of the European War in 1914 we have taken more petroleum from the ground than in all the years previous to that time. We have used over one-third of our total original petroleum resources and at the present rate our supply would be exhausted in less than twenty years. These figures are based upon the recent nation-wide survey of petroleum resources conducted by the U. S. Geological Survey and the Am. Assn. of Petroleum Geologists in collaboration with state geologists, company geologists and consulting specialists throughout the country. With only about 13 per cent of the world's petroleum deposits we are supplying over 65 per cent of the world's production. But since we own about 85 per cent of the world's automobiles it is necessary nevertheless for us to import petroleum to fill our needs.

Aside from those in Mexico a large part of the world's oil fields are not open to us. Improved methods of extraction and refining will postpone somewhat the exhaustion of our petroleum supplies since our present methods remove perhaps 20 per cent of the oil from the ground and an appreciable amount of this is lost. No doubt the fuel oil automotive motor is not far distant, and its appearance will relieve the situation somewhat. Nevertheless it is very unlikely that the demand for gasoline will be appreciably reduced, and the advantages of fuel oil are rapidly coming to be appreciated. We must therefore find new sources of oil fuel supplies.

Alcohol as a substitute for gasoline can be produced in almost unlimited quantities but its heat value is low and the cost is prohibitive as yet. By-product coke ovens will produce more and more benzol, but a low temperature distillation of bituminous coal will yield some twenty or thirty gallons of oil per ton of coal. Our oil shale deposits are by far the most promising future source of oil fuels, however. These deposits contain enough oil to supply our demands as far ahead as we can reasonably anticipate them. But the production of oil from shale in quantities approaching our present petroleum production would necessitate the building of a vast industry which would employ some 750,000 men in the mines alone. This of course involves large financial and economic as well as technical problems.

As far as coal is concerned there are good prospects that a generous supply will be available for some time to come and its use in the raw state for power purposes in communities where water power is not available will no doubt increase rather than

RUSTING OF IRON STRUCTURES

Iron Free from Impurities Best Withstands Climatic Conditions

By J. D. Frazer

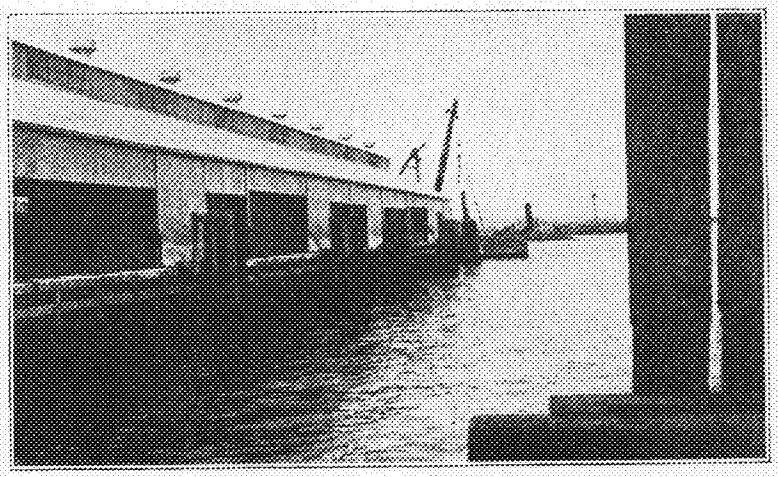
IN a recent article, Sir Robert Hadfield, head of what is probably the greatest alloy steel corporation in the world, Hadfield's, Ltd., Sheffield, England, stated that after a thorough investigation he was able to determine that during the year 1921 rust destroyed approximately 30,000,000 tons of iron and steel throughout the world, or practically as much as was produced that year.

World producing capacity for 1921 was estimated at 120,000,000 tons, but operation of iron and steel plants was much below normal. This loss of one-fourth or twenty-five per cent of the world's capacity of iron and steel in one year is appalling and strikes directly at the safety of a certain proportion of business investments. The preservation of iron and steel installations is a most important economic problem. Everyone pays a share of the rust tax and everyone should be vitally concerned as to how this tax can be reduced.

Ever since the advent of modern steel-making processes, it has been commonly felt that rust was a necessary evil affecting all ferrous metals and products alike.

During the last generation, however, scientists have clearly established that rust is primarily an electrolytic action which can be promoted or retarded while the metal is in the making. It is now understood that the place to combat and defeat rust is not so much after the product is finished, as while it is being manufactured. This is proved by the fact that there are standing, today, iron structures produced many years ago, and in some cases centuries ago, before the modern steel making processes had been developed, and also by the more generally known fact that sheet metal produced under ordinary modern methods lasts but a few years before succumbing to the rust disease.

but a very small percentage of the impurities found in the ordinary modern material. It has been firmly established that a pure, homogeneous iron, low in gas content, greatly retards the rate of corrosion. Iron chains used in a suspension bridge built at Newburyport, Massachusetts, in 1798 were removed in 1910 when the bridge was rebuilt and found to be unaffected by rust.

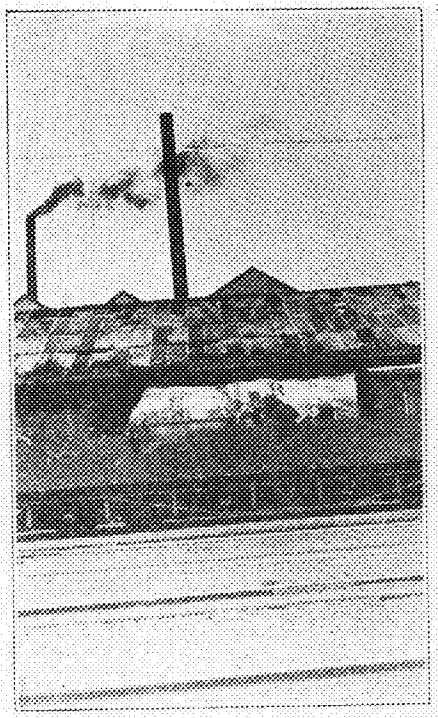


Dock Warehouse in Cuba. Siding Is Commercially Pure Iron Galvanized Corrugated Sheets.
Analysis of material—Sulphur, .035; Phosphorus, .005; Carbon, .012; Manganese, .020; Copper, .030; Silicon, Trace.
Rust producing elements are lower even than in the material on the St. Thomas Church and under like conditions should give better service.

Chemical analysis of such specimens prove them to be iron with a low percentage of impurities. In striking contrast to these long standing examples of rust resisting iron, is the accompanying photograph of a railway freight shed erected in South Africa less than ten years ago. The galvanized corrugated sheet metal roof has completely failed. Chemical analysis proves the material to be steel with a high content of impurities, similar to other ordinary present day sheet metal.

In the same district as the railway shed described above, and under practically the same climatic and atmospheric conditions, stands the old St. Thomas Church of Durban, South Africa. This church has been standing nearly 70 years within two and one-half miles from the seacoast, the original galvanized iron sheets have never been painted and they are in splendid condition today. Chemical analysis of this material shows it to be an iron low in the rust producing impurities.

The third photograph shows a shipping dock warehouse in Cuba, the siding of which is made of galvanized corrugated sheets of commercially pure iron. These sheets have been in service for six years exposed to salt air conditions, tropical sun and rains, and, being in excellent condition, give evidence of lasting a lifetime. Ordinary sheet metal on this same dock had to be replaced in three years.



Railway Freight Shed in South Africa. Analysis of Galv. Corrg. Sheets—Sulphur, .063; Phosphorus, .102; Carbon, .100; Manganese, .390; Copper, .128; Silicon, .008.

From the foregoing examples (and many others tabulated by scientists in their war against rust), it appears obvious that the first step in reduc-

(Continued on page 32)

UTILIZATION OF POWER AT HIGH DAM

Large Amount of Power Is Wasted Yearly— Regents Make Request for a Share

By Albert W. Morse

FIFTEEN per cent of the power developed continually at the high dam is being sought by the board of regents. This will be the University's allotment of the 81,000,000 kilowatt hours of energy, equivalent to 90,000 tons of coal, which is now being wasted yearly in the water flowing uselessly over the dam.

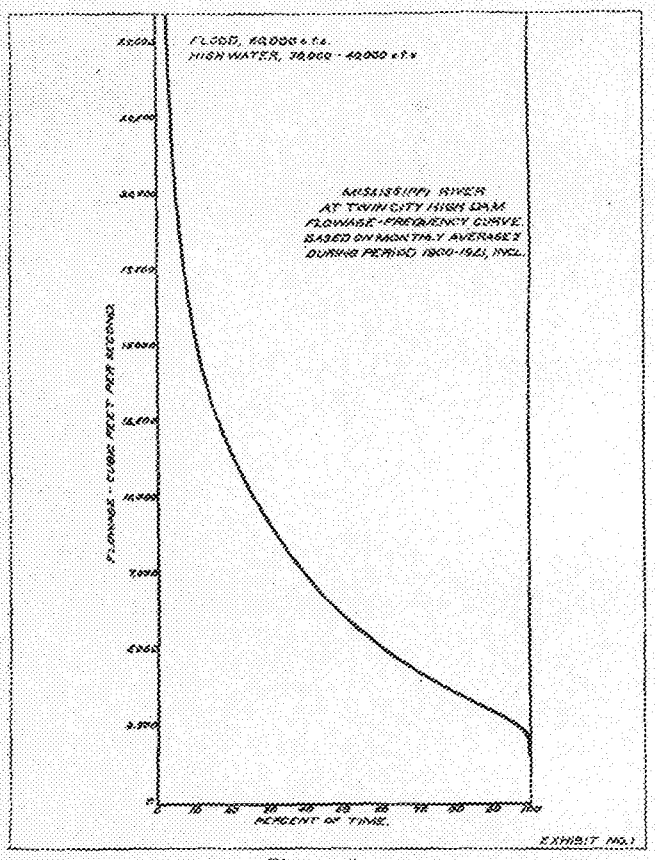


Figure One

Utilization of this power will mark the culmination of more than fifty-seven years of labor. Two million dollars have been spent on the project since the inception of a plan in 1866 to improve navigation on the Mississippi river between Minneapolis and St. Paul, and a million more will be required for the power station, including the building and hydraulic and electrical equipment.

Two disadvantages, variation throughout the year in headwater and discharge, reduce the desirability of the high dam for a power site, but the large amount of pondage partly counterbalances the latter. The low flowage occurs during the winter months, when the water comes almost entirely from rains of the previous year, and this deficiency can be supplied to a large extent by drawing upon the pondage above the dam, providing this would not interfere with river stations at St. Paul. Variation of flowage, based upon monthly averages from 1900 to 1921, is shown by exhibit No. 1. It will be noticed that extremely low water conditions prevail at only rare intervals of time, when the use of a standby plant will be required.

The available head at various rates of flowage is shown by exhibit No. 2. This curve is based upon the tail water data of government engineers, taking monthly averages from 1900 to 1921, and using three-foot flashboards at low periods. The variation of from 60,000 cubic feet per second at a head of 24.2 feet to 1,600 cubic feet per second at 37.5 feet is clearly shown. The head varies from 31.5 to 35.5 feet during only 80 per cent of the time, however, and the average of 33.5 is reliable to consider in selecting equipment.

Influence of flowage variation upon the production of power in kilowatts may be found by referring to exhibit No. 5. The reduced head caused by flood conditions brings the output down to 6,800 kilowatts, while the power varies from 3,900 kilowatts at the minimum flowage of 1,600 cubic feet per second to 12,000 kilowatts at 5,600 cubic feet per second, with the wheels taking all the water.

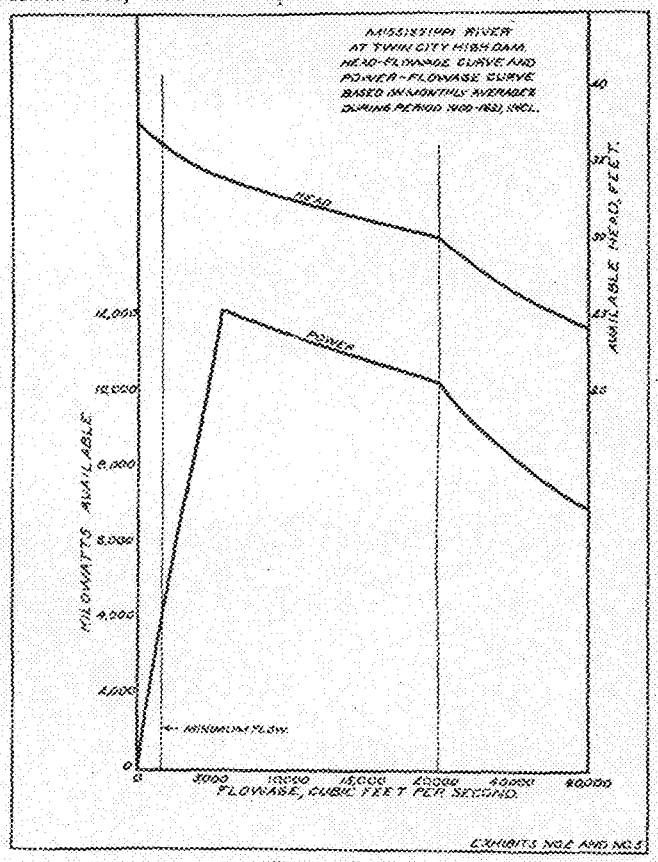
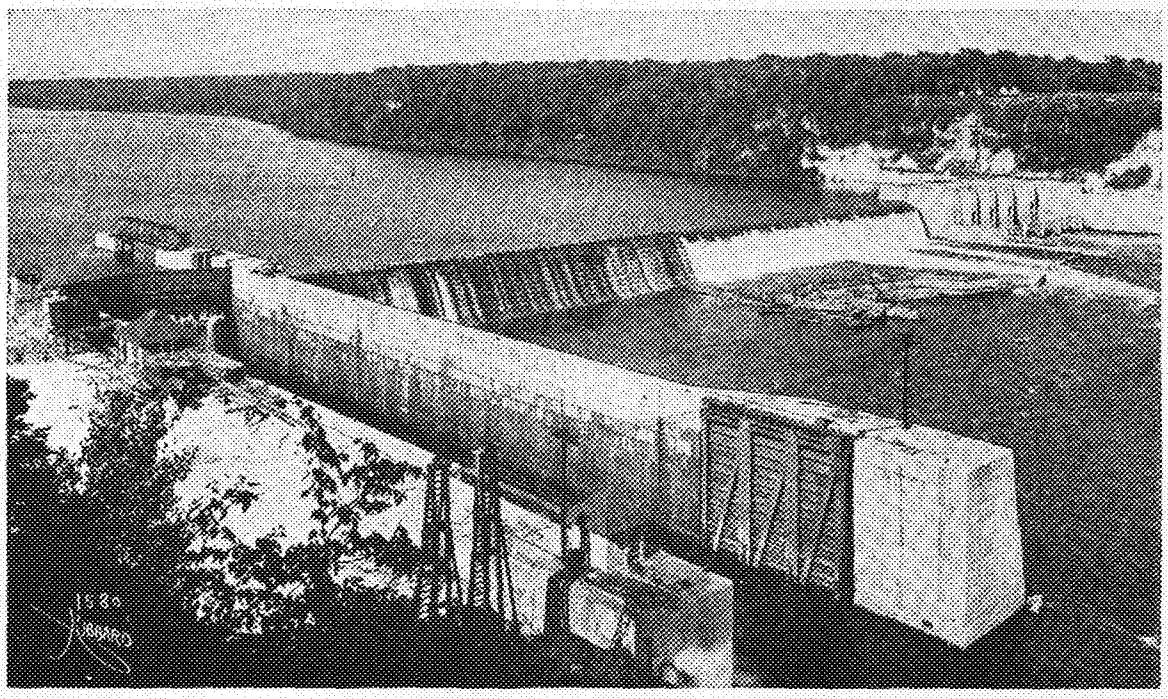


Figure Two

The University can use its power in various ways. Laboratory research in connection with the smelting of ore, purification of city water supplies, manufacture of fertilizer, and extraction of aluminum from clay are among the more pertinent problems at this time. Probably a large amount of the current will be used in lighting the University [illegible]



The U. S. Government High Dam, from the Minneapolis Side.
It is estimated that 81,000,000 kilowatts of power
flow over this dam every year.

The regents unanimously adopted the following resolution, which was offered by Governor Preus at their meeting of February sixth:

"WHEREAS, the Federal Government has constructed a lock and dam known as the High Dam across the Mississippi river between the cities of Minneapolis and St. Paul and has control of the use of the power obtainable therefrom, and is about to award the use of such power to one or more of several applicants, and

"WHEREAS, the State of Minnesota has claims upon the power obtainable from the High Dam which transcend those of other applicants, arising from the facts:

"(a) That the power available from the High Dam and the entire watershed whence such power is derived, lie entirely within the boundaries of the State of Minnesota;

"(b) That the Federal Government had nearly completed Lock No. 2 for navigation purposes only when members of the faculty of the University of Minnesota urged the construction of a High Dam, making available the energy of the 33 feet fall of water that would otherwise have been wasted, such presentation being followed by the abandonment of Lock 2 and the substitution of the High Dam;

"(c) That the State of Minnesota, through its University and affiliated experimental research stations, is now co-operating with the Federal Government through several of its bureaus in various kinds of research work for which power is required, and there is an increasing number of researches that would be greatly facilitated and made more effective if ample power were available, such researches being likely to eventuate in discoveries or other developments of great benefit to the nation;

"(d) That the University of Minnesota is unique [illegible] universities already affiliated with the Federal Government in various co-operative activities, in being the only one close to a large water-power now under government control, and is therefore the logical institution which should be selected for jointly carrying on researches that require large amounts of power;

"(e) That the possession of ample power for research purposes by the University would, in association with military or other branches of the Government, be of incalculable value in developing processes and solving problems of a military or economic nature, and in case of military emergency, such laboratories already in working order and fully manned could begin immediate study of problems demanding prompt solution;

"WHEREAS, the use of a reasonable portion of the power and energy obtainable from the High Dam by the University of Minnesota for experimental research work has met with general approval,

"THEREFORE BE IT RESOLVED, That the Board of Regents of the University of Minnesota urge the Federal Government to incorporate in any and every lease or other disposition of the power from the High Dam, across the Mississippi river between Minneapolis and St. Paul, a proviso that the University of Minnesota shall have in perpetuity the right to use for its purposes the water necessary for hydraulic tests and experimental research, and the grantee of the power from the High Dam shall continuously deliver to the University free of cost at the switch board at the powerhouse, fifteen per cent of the power that can be developed at any time from the water then flowing in the river."

* * *

Power calculations are printed through the courtesy of J. C. Vincent, mechanical and electrical engineer for the City of Minneapolis.

A NEW CALENDAR FOR MINNESOTA

Engineers Do Caesar One Better and Celebrate St. Pat's Day on Friday the Thirteenth

MINNESOTA Engineers this year will tear up the calendar and celebrate St. Patrick's Day in April—Friday the Thirteenth. On that day rites of one of the oldest campus traditions will be celebrated with increased enthusiasm, despite the unprecedented change of date.

The St. Pat's celebration, originated at Minnesota in 1903, has ever been the Engineers' greatest annual experience, and in late years has acquired greater value, in that the very nature of the celebration has impressed the growing importance of the Engineering College upon the entire University. Features which stress engineering activity have been added, while none of the treasured traditional events has been discarded.

The program this year will include the knighting of senior engineers in the Guard of St. Patrick, followed by doing of homage to the Blarney Stone (unearthed during the excavation for the Engineering Annex in 1903 and treasured since then as the Engineers' proudest possession), the parade, green tea, open house and Engineers' Ball.

Minnesota's celebration gains dignity from the fact that nine other great engineering schools, united with her in the Association of Collegiate Engineers, stage similar celebrations; so St. Pat's celebrations enjoy national recognition.

The Association of Collegiate Engineers is an outgrowth of the old Guard of St. Patrick. The purposes of the organization are to promote student government, to encourage the exchange of ideas and experiences, to promote student enterprises such as co-operative bookstores and publications, and all other activities which touch on engineering work.

The last meeting of the Association of Collegiate Engineers, generally known as the A. C. E., was held at the University of Oklahoma, at Norman, Oklahoma, February 15, 16 and 17. Student chapters from the University of Oklahoma, Oklahoma Agriculture and Mechanics, Washington University, University of Missouri, Missouri School of Mines, University of Tennessee, University of Colorado, University of Arkansas, Ames and Minnesota attended the convention. The Association of Engineering Students at Minnesota was represented by Harold E. Peckham, senior delegate, and Harley R. Langman, junior delegate, who gained the next annual convention for Minnesota, to be held here early in 1924.

The trend of activity towards a broader celebration was noted in exchange of ideas at the convention. Only three schools of the ten still celebrate St. Patrick's Day on March 17. Students in most other institutions have found March 17 unsuitable because of interference with final examinations and unfavorable weather conditions, besides religious objections which have been brought to bear in at least two institutions. The University of Missouri, Missouri School of Mines and Ames still celebrate on St. Patrick's Day.

In other schools, with one exception, there is no attempt made to forsake traditional tenor of St. Pat's activity. The University of Tennessee celebrates Ace Day, taking its name from the A.C.E.

Celebrations in most other chapters are similar to that at Minnesota. The Knighting of Seniors in the Guard of St. Patrick is called for by the national constitution; the Engineers' Ball is a social function observed at all universities. Parades are not usually held in the smaller schools, nor is so much stress laid on open house at some other chapters.

The celebration at Rolla, the Missouri School of Mines, takes the form of a three day frolic for Engineers, little of the celebration attracting attention from citizens of the town. House parties at the fraternities, at which out-of-town dance guests are entertained for three days, are customary, with a dramatic production staged by the Engineers to entertain their guests' and other features.

Ames stages a three day celebration, in conjunction with other departments of the college. Each of the departments entertains visitors at open house, while the Engineers include in the celebration their St. Pat's rites.

The University of Colorado has no St. Pat's celebration, other than the Engineers' Ball staged on that day. Their principal activity is an Apple Fest, at which visitors to the Engineering College are entertained. Tennessee's Ace Day is based on the "picture cards" of a deck of playing cards, the organization being built around those characters. In a number of schools a popular co-ed is chosen as St. Pat's queen to add dignity to the celebration.

Minnesota's celebration is supervised by the junior class in engineering, under general direction of the Association of Engineering students. The juniors each year elect the general chairman, who in turn appoints his executive committee from the junior class. All classes and departments then are called on to promote the success of the celebration. Underclassmen usually take a large part in open house activities, running the shops at the Mechanical building, while upper classmen operate equipment at the Experimental building and demonstrate work of the departments. All classes and departments take part in the St. Pat's parade, staged during the noon hour on the celebration date.

In the past two years an earnest attempt has been made to interest alumni in the celebration and to encourage them to return to the college on that day. A meeting room for alumni is provided and special attention is paid to their entertainment.

The Green Tea which Minnesota observes is unique in the A.C.E. For several years it has been the custom to receive and entertain visitors from the main campus and from over town and out of town at a tea dansant, given in the Engineering building. Last year several hundred guests were entertained, dancing space being provided in the Engineering auditorium and the Engineering library, and refreshments being served in the downstairs library, the architectural library and on the

(Continued on page 28)

ALL-'U' FRESHMAN YEAR STUDIED

Professor Bass Makes Report on Handling of Freshman Problem in East

By L. A. Tvedt

THE student in the professional colleges of the University should be interested in the plans, now being considered by the Administration, for the improvement in the method of handling the Freshmen, as the technical groups will be affected more than any others by changes that may be brought about. The need for a change from the present system is being felt rather strongly by the Administration.

Under the system now in use the Freshmen register as academics, miners, engineers, etc., and begin at once to consider themselves allied with a college group rather than the University as a unit. As the student progresses in his school work and joins professional societies and organizations the spirit of college individuality grows and becomes stronger, rather than tending to disappear. At present it seems as if this college spirit, which is in itself a highly important and commendable factor, has advanced so far that a lack of centralized school spirit, which is so essential in a university, is beginning to be felt. If by some means the Freshmen could be impressed with the importance and desirability of the All-University spirit, any change that might possibly bring this about would be worthy of consideration.

In addition to the lack of centralized spirit, which the administration is trying to correct, another factor enters into any plan that has for its purpose the improvement of the method used in conducting the work of the freshmen. That element is the lack of certainty which many freshmen have as to the exact kind of work for which they desire to prepare themselves. At present the possibility of the student getting much help from the University in this matter is very slight. After spending a year or so at a particular course it often happens that the student realizes that he has not chosen the right course and finds, in general, two ways to go on. He can change to the course in which he thinks he will find greater benefit, or he can keep on with the course that he is taking. In the first case he is likely to find that his time and work already spent are of little use to him; in the latter case it is likely that the student will fail to get the benefit which he should from his University training. Some system which would provide a means of helping the freshmen "find" themselves, would fill a long felt want.

Professor Bass of the College of Engineering and Architecture has recently returned from a trip in the East where he studied the freshmen systems being used by Yale, Harvard, Princeton, Columbia, and some of the other schools in the same territory. He says that these schools, through the medium of special dormitories, courses, and advisers chosen from the faculty and the senior class, specialize on the training of the freshmen, and save themselves and the students an endless amount of expense, worry, and confusion.

It is usually admitted that dormitories are a great help in developing school spirit, as well as providing a common ground on which students can meet and learn to know their fellow students. This brings about a feeling of cosmopolitanism and fellowship that helps the students realize the value and importance of centralized spirit. But it hardly appears that the dormitories offer the best or most immediate solution of the problem here at Minnesota. The metropolitan districts of St. Paul and Minneapolis furnish a large percentage of the students and any system of compulsory dormitory residenceship would be rather out of the question. In addition, at present there are no funds available with which to build the extensive dormitories that would be required by the adoption of such a plan. The possibility of having groups of men from particular colleges take over small dormitories as they are acquired by the University, will without question give rise to a better spirit among the students of any such group; but the good which might arise from any such arrangement, as far as All-University Spirit is concerned seems rather limited. Neither will it help solve the problem of helping the new student find his correct course.

The plan of assigning freshmen advisers from among the faculty of senior class has several points to commend it. In theory it would provide the student with an adviser to whom he could go with his problems and troubles. For the system to be of much use it would be essential that the advisers be selected with great care in order that they would be capable of giving the freshmen students the necessary help and advice. It would rest with them to gain the confidence and respect of the students which would be needed for the system to work to the best advantage.

By means of special courses in orientation, etc., something might be done to help the student get a broader view of the field in which he was thinking of entering, but the chief usefulness of these courses would be in helping the student decide on the branch in which he would specialize, within the profession, rather than helping him choose a profession. But at present the room for courses of this kind in the average program is rather limited.

The plan recommended by the committee appointed to investigate possible solutions for this freshmen problem, is that of the "All-University Freshmen Year." Under this plan all freshmen would enter on an equal basis and would register as member of the university, putting off for one year all affiliations with any particular college. During this year the student's task would be to survey as thoroughly as possible the field which he contemplates entering. It would give the student a chance to acquaint himself with the ways and traditions of the university and instill in himself that spirit and ideal which goes so far toward making a great Alma Mater. It is possible that additional equipment, etc., would be needed to take care of the added number of students that would be at the uni-

(Continued on page 28)

EDITORIALS

A "DAILY" TAX?

Where is that Minnesota Spirit of which we are wont to speak? Second in size among the universities of the Big Ten, Minnesota is the only one so lacking in money, interest, or ability (or whatever may be the cause), that it cannot publish and sustain a Daily. Too much of late we have been compelled to bow to the prowess of opposing athletic teams. Must we admit our inferiority in this respect also, and agree that the Minnesota student is of different mental caliber,—that he cannot do things which others accomplish? Let each one of us answer for himself when asked to assist in reestablishing the Minnesota Daily,—but do not wait to be asked.

It may be that the Daily was its own excuse for failing, but that is an open question. There remains a no less real need for the unifying influence of an all-university publication, here especially where **university** spirit is threatened and scattered by a great diversity of outside influences. But we do not propose to argue the value of a daily,—that is proved by the many in existence in other schools similar to ours.

A solution to the problem has been proposed,—one which is reasonable and quite satisfactory. Under this plan, the Daily will receive financial support from a blanket tax of fifty cents per quarter, to be deducted from each student's general deposit. In this way adequate support will be afforded the management, at a much less cost to the student than under the former plan, because of the increased circulation. And then those who were forever reading "someone else's Daily" will have to contribute their share to its support. The Board of Regents will be petitioned for the necessary authority, which it is believed may be readily obtained if it is evident that the students want it.

Where is that Minnesota Spirit? Let us controvert those who say it is dead, or at least dying, by removing the many apparent evidences of its decline, by arising from indifference and criticism to positive action.

A REAL ENGINEER

Are you an Engineer? Are you a good engineer, a good student, a force in your college, a participant in its various activities? If not, you are a very genuine loser and your college loses your services.

A great many men in the college once looked upon activities outside of athletics with a certain supercilious air. They felt that only a mansized profession or a redblooded sport was of any real interest to them. The things that went to make up a rounded man, tactful in the presence of others, capable of mingling on an even basis socially with people, they considered largely unnecessary. The background of History seemed far off and of no great consequence. Philosophy, sociology, rhetoric, none of these subjects filled a well recognized need in the scheme of their lives. They considered that theirs was the field of the inanimate and undeviating laws of nature. Neither man nor business seemed more than remotely related to their future and even then these could be safely left to specialists dealing with such things.

But that is no longer the case. Engineers are to be found in practically every activity. We find them staging campus drives. Some we find taking public speaking and belonging to literary societies of various kinds. In dramatics they take an active part, either as an Arab or through one of the more general dramatic organizations. On Sunday mornings a goodly quota of them are to be found occupying accustomed places in the neighborhood churches. A certain demand is growing, slowly but surely for a pre-Engineering course or for a longer course with an admixture of more academic or elective subjects.

What does this mean? Simply this, that we are beginning to realize that we can no longer afford to isolate ourselves intellectually from our brother men. There is a great sufficiency of engineers, but the field is wide open for the engineer skilled in his own profession, but, even so, trained to consider political and economic problems intelligently, capable of mixing advantageously with people, having a certain knowledge of those things that mark a cultured man. He feels that he has handicapped himself in his pursuit of happiness if he has not added a little knowledge of literature, a certain appreciation of music, a fairly well developed taste for art and beauty, and a good working acquaintance with social usage.

CITY WATER SUPPLY

Year by year the demand for water in cities becomes greater. In 1842 the average daily consumption of water per capita was 20 gallons. In 1915 the average consumption in 201 cities was 139 gallons per capita. The present average for 46 cities is 169 gallons per day. Thus a city whose growth is rapid and whose population is great must, at some time, seek to increase the water supply.

Recently New York City completed what is undoubtedly the biggest water project in the world. A 15-foot cement lined tunnel was run from the Catskill mountains—over 100 miles from New York—underground to the city, under the foundations of the skyscrapers, and under the Hudson River at a depth of 1,114 ft. into Manhattan. Cuttings were made through rock largely. The reservoir in the Catskills is built in a valley which had been supporting 9 villages with all their conveniences. Mr. J. Waldo Smith was the engineer in charge.

The use of alcohol in motor fuels has been made compulsory in France by a bill which recently passed the Chamber of Deputies.

ALUMNI NEWS

MINNESOTA GRADUATES BUILD OUR HIGHWAYS

By Marshall H. Coolidge, Jr.

SINCE the adoption of the Babcock Good Roads Plan the activities of the Minnesota State Highway Department have increased rapidly, requiring the services of a large number of engineers, both in the field and in the office. The great majority of these are Minnesota Engineering graduates.

J. T. Ellinson, '09

Mr. J. T. Ellinson is the Second Assistant Commissioner and Bridge Engineer. He graduated in 1909 in Civil Engineering. He was so busy working to make both ends meet that he did not take a very active part in campus activities.

C. L. Motl, '10

In the Bridge Department as an assistant to Mr. Ellinson is E. J. or "Spike" Miller, who has charge of the repairing of old bridges and assists occasionally in the building of the new ones. He graduated as a Civil Engineer in 1911. As Assistant Construction Engineer, Mr. D. W. Webster acts as "dietitian on Noah's Ark" by which we mean that he is an assistant to the construction engineer who has charge of all the surveys, plans, right of way, and construction on trunk highways and state aid roads. He was a member of the second class to graduate in the five year Civil Engineering course. Mr. C. L. Motl, '10 C. E., is the Division Engineer for Division No. 8 in the southwestern part of the state. This division consists of about twelve counties and has about 1,000 miles of state trunk highways and about 1,800 miles of state aid roads. He is a member of the St. Paul Civil Engineers' Society, and is vice president of the Minnesota Surveyors' and Engineers' Society. He was a member of Tau Beta Pi and Sigma Xi fraternities, and was for two years on the staff of the Minnesota Engineer.

Mr. A. L. Flygare is engineer of the division including Otttertail, Wilkin, Clay, Becker, Mahnomen, Norman, Polk, Red Lake, Pennington, Marshall, Roseau, and Kittson counties. He has been with the highway department since 1913. He graduated in Civil Engineering in 1912, and in 1912 and 1913 was with the Canadian Northern Railroad. While in school he was a member of the Scandinavian Society and the Engineers' Society, and is now a member of the St. Paul Civil Engineers' Society and the Minnesota Surveyors' and Engineers' Society. Mr. J. C. Robbers, ex-'17, is Office Engineer in the Construction Department. He is a member of the St. Paul Civil Engineers' Society. He was a member of the Theta Tau fraternity.

An interesting letter was recently received from Don Campbell, who has been working for an architect's firm in New York. He tells of the beauty of the silk show from an architect's point of view.

"...I went to the New York silk show Saturday last, and while the name may sound effeminate, I want to tell you that it was architecturally an education. Everyone has heard of 'Cheney' silks and while rumor says their exhibit and expenses ran into a quarter million dollars, it is easy to see where $100,000.00 would come in and far be it from me to deny the larger figure. Their exhibit was arranged along a two hundred foot front, like an architectural vaulted passage. It was laid out by an architect (I don't remember who) and some interior decorator. As you enter this arcade (with booths about 16 feet across on either side) you see a large stone vase draped with silks. The background is silk, the ceiling silk, everything except for a few architectural features is silk. It is the most gorgeous thing I have ever seen. It surpassed my wildest imaginings of oriental splendor. In fact I never dreamed they made one one-hundredth of the different varieties of silk fabric shown. To an architect or decorator it showed the unlimited possibilities of fabric in obtaining architectural effects. I am only sorry it is impossible for all you fellows to see it, as I know, outside of the pleasure to the eye, it would be of high educational vlaue.

"My advice every day in every way, etc., is stronger than before I came East to hit your freehand hard. Those fellows are the ones who are capitalizing on their knowledge and the ones that get the pleasant work in the office. And my next urge is for any of you that can afford it, or can starve comfortably, to try and work here for a few years. We don't know the first principles of how to practice architecture in the West and it would do your heart and soul worlds of good to get the right sort of experience when you first start out.

And remember, that New York demands careful draftsmen—none of this school rush stuff.

"Harold Barber is located with the California Edison Co. in S. A., Cal. In a letter received from him some time ago, he tells of the large-scale construction work being carried on out West."

Big Creek, California, Jan. 27, 1923.

My dear Mr. Zelner:

Now that I am out here and by all appearances permanently located, I will write and let you know how I am faring.

For the first three weeks after getting into Los Angeles, I was busy taking in a few of the sights. The weather was wonderful, too hot if anything, which seemed somewhat different than 40° below weather in North Dakota on our way out. In two days in L. A. the temperature reached 90°, which took the pep out of everybody.

There is lots of work going on around L. A. but it is hard to break in, in the engineering game, and salaries are rather low.

The job I have is with the California Edison Company. I hired out as chainman for their Big Creek project, which is in the High Sierras about 100 miles north east of Fresno. The turn-over is big up here and one ought to get a transit job up here if he sticks out a few months.

From Fresno I came up as far as Cascade on the main camp on a little mountain railroad, the San Joaquin & Eastern; from there it is a twenty-seven mile hike all in snow up to this camp No. 61. The elevation here is 7,100 and well above the snow line.

The Big Creek project is the largest construction work going on on the Pacific Coast. It consists in tapping the San Joaquin river about 6 miles north of here, and diverting it through a 17 mile tunnel into Huntington Lake, which is used as a reservoir. From there it drops down about 2,000 feet to Cascada, where their power station is located. At present they are running and getting their power from the natural waters of the lake.

Eventually they will tunnel two more mountains below Cascada and put in two more generating plants, thus using the water three times in its course down the mountains.

They have been working about four years and expect it to take fifteen years more to finish it, approximately 5,000 men on the job now.

Camp No. 61 where I am is about half way between the river and Huntington Lake. From here they are tunneling toward the lake, while at Camp No. 60, located on the north end of the lake, they are tunneling toward us. Under Kaiser Pass the tunnel will be about 3,000 feet in the ground.

They are in about 6,200 feet from the entrance here. They run three shifts a day, seven days a week, and progress about 85 to 100 feet a week.

Our work consists in giving them centerline and grade elevations after every shot and paint the tunnel arch on the heading so they can locate the powder holes. As they only shoot every 14 to 18 hours, we are not rushed very hard as it only takes us about 1½ hours in the tunnel to give them the dope. Outside of that we have to take about three cross-sections and check up on a few spad deflections, every week.

The work is entirely different than anything I ever experienced before and is certainly interesting. I figure I can get some good experience anyway.

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THE ELECTRIC RAILWAY FIELD AND THE YOUNG ENGINEER

The electric railway field offers today to the young electrical engineer one of the most interesting and effective possible lines of endeavor for his life work. The important thing is not what the young engineer does the first years after graduation, but what he is doing ten, twenty years after graduation, and, more than that, whether he is temperamentally at one with the work he is in, to the extent that it is a never failing source of interest and attraction to him. To enjoy work in the electric traction field one must, at least in the common construction or operating end of the game, be able to take pleasure in an active, almost continuously active, life, one full of pulsating ups and downs, one slamming up against emergency problems of considerable magnitude requiring solution at once. But for the man of initiative, nerve, one who likes to make things move, it is a real life.

The largest present opening in this field is that of the city and suburban trolley service. Here the engineering of equipment selection, operation, and maintenance may be fully of co-ordinate importance with the managing end. In fact, on many small systems the engineer is also the general manager.

Experience of the New York Central; the New York, New Haven and Hartford; the Piedmont; the Pennsylvania and other systems, and especially of the Chicago, Milwaukee, and St. Paul line, show the tremendous possibilities of such electrification. The St. Lawrence waterway development with its enormous electric power proposition if carried through will exert a tremendous pressure towards the electification of possibly thousands of miles of present steam line trackage.

The smoke nuisance, the necessity for quicker and more frequent commutation service has already resulted in the electrification of several steam railway terminals, notably the Forty-Second Street, the Hudson and the Pennsylvania terminals in New York city and the Pennsylvania terminal in Philadelphia. The South Station at Boston and the Union Station at Washington were built so as to permit of easy future electrification. The Illinois Central is now about to start the electrification of its Chicago terminal after a long delay due to the war. The newspapers have just carried the announcement that the Chicago, Milwaukee and St. Paul is planning an early electrification of the section of its main line between LaCrosse and Minneapolis. This will be their third section, giving them over one thousand miles in total. The proposal is to draw the power from the hydro-electric generating stations to be erected along streams in the northeast section of Wisconsin. This will involve the expenditure of millions of dollars and years of time. When completed it will be one of the most effective demonstrations of electrification in the United States—*Wisconsin Engineer.*

The architects at the University of Illinois have established a new tradition in their department, which involves the wearing of a Windsor tie every Thursday as a mark of distinction from the ranks of their fellow students. They express it as an "added distinction" because it was thought for a while that they might carry a drawing board around with them all the time, but since that is a necessity anyway, the Windsor tie solved the solution.

—*The Technograph*

WATER-BORNE TRANSPORTATION

Showing the Advantages of the Proposed St. Lawrence Project Over Our Present Facilities

By Colonel John Millis

The following paper by a Colonel in the Corps of Engineers, U. S. Army, which appeared in the Journal of the Western Society of Engineers, is reprinted by special permission.

WE are all tolerably familiar with most of the questions of water-borne commerce that are near at hand and when looked at from the Chicago viewpoint, and so, in an endeavor to inject something of novelty into an old and oft told story and perhaps with the result of disguising in a measure its antiquity, let us turn the subject the other way about and approach Chicago by water from outside. First from New York, starting from the new state barge and terminal on the lower East River water front of Manhattan—Pier 6. We have a fleet of four modern steel barges adapted to the New York Canal, one provided with propelling power to tow the others, according to the latest recommendations of the State canal authorities. These vessels are each 150 feet long, 21 feet beam, draw nine and one-half feet of water, and have nothing projecting above deck that would interfere with passage under fixed bridges affording 15½ feet head room. Cargo is made up of manufactured articles or goods—package freight—for Chicago, and is stored in the holds below decks and protected by the hatch covers. We round the Battery and start up the Hudson. Aside from the numerous other vessels of all kinds in the lower river which we must keep clear of, navigation under ordinary weather conditions presents no difficulties. The Hudson is a remarkably straight river and is a tidal stream all the way to Troy, 150 miles—that is, the current is alternately down and up stream, the former of course predominating. Only one bridge is passed before reaching Albany, the high level railway bridge at Poughkeepsie. The Government dam at Troy is the first obstacle and this is passed by the lock which takes the whole fleet at once and lifts it to the level of the Hudson pool above. A short run leads to the first of the five locks at Waterford by which the fleet completes the total rise of 183 feet to the lower pool of the canalized Mohawk. The speed in the Hudson may have been eight or nine miles per hour, but from the beginning of the canal system at Waterford it must not exceed six miles. The course is now through the canalized Mohawk to near Utica—a succession of dams with locks, dredged places in the river, and numerous rectifying and side cuts and dredged channels; also frequent bridges. The elevation gradually rises to 420 feet above tide at Utica, and from this point to the Niagara River the channel is largely excavated canal proper, with deepened and dredged portions of Oneida, Seneca and Clyde rivers and Tonawanda Creek, and there is a stretch of 20 miles of open water channel through Lake Oneida. The grade drops from 420 feet at Utica to about 360 feet at Syracuse and then rises gradually to 566 feet, the level of Lake Erie. At Tonawanda, not far above Niagara Falls, we enter Niagara River and proceed upstream to Buffalo. The total canal length from Albany is about 340 miles. The whole trip from New York can be made by continuous night and day travel as the locks are all lighted and attended throughout the 24 hours and the courses are provided with light and other marks as aids to the navigator. The narrowest portions of the canal are 75 feet wide on the bottom, and this is sufficient for passing other fleets or individual boats not wider than ours. For this size of craft the canal is therefore a double track. So far it has been followed the entire distance from New York on both sides by multiple track railroads of the highest modern development, and these have unusually favorable grades throughout. The only exception of note is the climb of about 185 feet out of the valley of the Hudson between Albany and Syracuse.

As a practical fact under present conditions our Chicago cargo goes no farther than Buffalo in the canal barges, considerably less than half the distance by direct lines, and it is now transferred to a vessel of a type adapted to navigating the open lakes which proceeds to its destination by the Straits of Makinac, while the barge fleet takes a return cargo and goes back to New York.

Here, however, it is appropriate to consider an extension of the journey that is already physically practicable, if not economically advantageous. With ordinary good weather conditions the barge fleet could traverse the south shore of Lake Erie as far as Toledo and even go on to Detroit and Port Huron, with harbors of refuge from 25 to 50 miles apart all along the route, but the risks of navigation on the larger lakes and great distances between sheltered harbors would preclude farther progress. If we assume the Maumee River developed for water power and canalized, as has been proposed, the same fleet could go as far as Fort Wayne, Indiana, but it would then still be about 100 miles from Lake Michigan at either Michigan City or St. Joseph and 150 miles from Chicago. Observe here that the part of this route from Buffalo to the west end of Lake Erie is also paralleled both sides by railroads, and note the extensive development of rail transportation between Toledo and Detroit on the one hand and Chicago on the other. And all these rail routes have quite exceptionally favorable grades.

Now let us start out with a cargo for Chicago from the only other Atlantic seaport with which there is direct connection by water at present, the port of Montreal. This is accessible to seagoing vessels which come up the broad natural channel of the lower St. Lawrence practically as far as Quebec, and then the remaining 150 miles is through a succession of reaches with open channels enlarged by dredging. The Lachine rapids, the lowermost in the river, constituted the first serious obstacle encountered by the early navigator, and it was this

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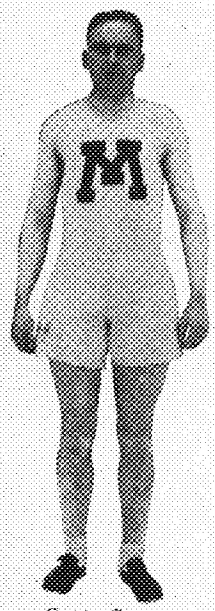
SPORTS

VARSITY ATHLETICS

Track Coach Metcalf has held a number of inter-class, intercollege, and interfraternity track meets during the last month in the hope of discovering some promising material for his indoor team. The track team has suffered a severe setback on account of the ineligibility of a number of the veterans, but it is hoped that things will clear up by the time the outdoor season starts. Stew Willson, Junior Mechanical, has been elected track captain for this year. He will be Minnesota's best bet in the dashes this year.



Capt. Stewart Willson

The varsity wrestling team has been meeting some stiff opposition this year and due to the scarcity of experienced men, with the exception of Captain Brown, they have lost all three of their dual meets this year. Captain Brown has been the only consistent winner on the team.

INTER-COLLEGE HOCKEY

The schedule of hockey games between the different colleges on the campus was started so late that only one game was played before the warm weather came. In this game the Engineers defeated the Ags 3 to 0. The game was more one-sided than the score shows. In the last period our goal guard, Ed Bergquist, didn't have a single stop and only had three or four in the other periods; while the Ags man was kept busy all the time. The Engineers team included the following men: Ed Bergquist, Phil Bergquist, K. Bros, Gustafson, Peck, Berg, Arsted, Hubbard and Lund.

INTER-COLLEGE BASKETBALL

The Engineers and Miners are tied in division one in the inter-college basketball series, each having two wins and one loss; and the Ags are leading in division two.

In their first game the Engineers lined up against the Foresters and were defeated 19 to 11; but the game was protested on the grounds that the Foresters used Freshman squad men, and will be played over. Our gang ought to win in next game as they were having hard luck shooting that night and couldn't seem to make the ball stick in the basket.

The Miners won the next game by a score of 25 to 19. The game was fast and exciting all the way through. The Miners had uncanny luck with their long shots, more than three-quarters of their baskets being made from the center of the floor or beyond. The Engineers spurted in the last five minutes, Tews making three long ones in rapid succession and Tatham one long one; but this was not enough to win.

The Engineers won the next two games, defeating the Chemists 34 to 10 and the Dents 28 to 10. Williams was the leading scorer for the Engineers in both of these games, getting 8 baskets in the first game and 9 in the second. If he had been playing in the Miners' game the result very probably would have been different. Johnson has been running him a close second in scoring honors.

The members of the Engineers team are: Forwards, Williams, Johnson, Galvin, Tews; centers, Braddock, Louderquist, Olson; guards, Mitchell, Franz, Tatham, Freburg, Manger.

SOPHOMORES WIN INTER-CLASS TITLE

With victories over all three of the other classes the Sophomores have a clear claim to the class basketball championship. All the games were hotly contested, the Seniors, who were the runners-up, making the game last an extra five minutes before losing. The scores of all the games are as follows:

Seniors, 10; Juniors, 5.
Sophomores, 14; Seniors, 12.
Juniors, 14; Freshmen, 10.
Sophomores, 19; Juniors, 8.
Seniors, 11; Freshmen, 8.
Sophomores, 14; Freshmen, 7.

The members of the winning Sophomore team include: Tatham, Bros, Freburg, Galvin, Brisson, Burns, Larson, and Manager Phil Hartman. An effort is being made to secure some sort of an individual trophy for these men.

HOCKEY

In its second year as a recognized sport, the Gopher hockey team brought home a championship. The team went through a season of 12 games with only one defeat and one tie game, a showing upon which Coach McDonald and his men are to be congratulated. The two final games of the season were played against Wisconsin at the Hippodrome, and were real humdingers. The first of the two-game series went to a scoreless tie in the three regular periods, but was pulled out by pretty work by Bartlett, Minnesota wing, in the extra period, the Gophers winning by a one-point margin. The boys came back the following night playing like demons, and took the game by a 4-0 count, Swanson of the Engineering contingent finishing his career in a real blaze of glory, exhibiting some of the prettiest hockey displayed on local ice for many a day.

Hockey has as yet not been recognized by the Senate Committee as a major sport. Last year the team, after a good showing, was awarded a special letter and a sweater for their work, but this award did not carry with it the privileges of the major "M." This year the team, and those who have been following the sport, feel that the work done and the showing made warrant recognition of hockey as a

(Continued on page 29)

COLLEGE NEWS

ARCHITECTS

Announcing an
Invitation to Membership
ARCHITECTURAL CLEARING-HOUSE
Sophomore Drafting Room

Sessions daily, with special conferences on Saturday.
This is not the New England, but your credit is good here all the same. Join with us. Learn how to be a financial wizard. We need your moral support.

FEBRUARY DESIGN AWARDS

A number of problems have been judged this month. Among these was the first Freshman problem in design: *A Doorway In A Retaining Wall.* In the solution of this problem Porter Kilpatrick won first honors, receiving an A. B-plus was awarded E. W. Bingham, Mary Slocumb, and D. Doon; B was awarded Helen Parker, Cyril Pesek, D. Mann, Bernice G. Kimerle, and Verna Smith.

The winter quarter of Sophomore design opened with an epidemic of three sketch problems instead of the customary short problem. High awards here were received by P. P. Bross, George Freeberg, Iver Lauttamus, Theo. Jan Prichard, and Rahel Rosenberg. An additional sketch problem held during the progress of the long problem earned credits for Gladys R. Hernlund, E. W. Krafft, Dorothy Brink, Homer W. Tatham, Theo. Jan Prichard, C. P. Edwards, P. P. Bross, and J. C. Christenson. The problem was entitled *A Moving-Picture Theatre Facade.*

A Street Clock was the subject of the Junior short problem. Olaf S. Fjelde received Mention Placed First in this problem; Mentions were awarded C. P. Erickson and H. A. Magoon.

In the Interior Decoration problem, *A Candy Shop.* Mentions were awarded Olive Prescott, Carl Matthias Wise, and Marion Petri.

The one Mention Commended of this year's vintage thus far fell to the lot of Eddie Holien in his solution of the Senior short problem *A Reception Room on a Steamship Pier.* Mentions in this problem were received by E. L. Johnson, John A. Walquist, R. F. Hennessey and Theo S. Sime.

REVIVAL OF QUAINT OLD-TIME CUSTOM

Many hearts in the Architectural Department were a-flutter on February 14, the feast of the good Monseignor Valentine. Two large slotted boxes had been installed in the hall, where the love-lorn, under pretext of going to the drinking-fountain, could insert their billets doux, well knowing that Dan Cupid, through the ministration of his pupil, Olive Prescott, would bear them safe to their proper destinations. Everyone was thirsty that day, the drinking-fountain almost ran dry.

At length the awaited hour was nigh—it was half after four—and a cry of eager anticipation was wafted through the halls. A breathless, mail-crazy audience surrounded our Cupid's mailman in the Senior Drafting-Room. One by one the pretty tokens were distributed: the air became fragrant with the odor of sweet wishes, rosy with the bloom of reflected blushes, musical with the sound of slushy gushes.

Professor Arnal struck a match, and was just about to light a cigarette when he opened his valentine. It was a camel—almost life-size. Should he light the Camel or the camel? It was very confusing.

Our office-boy was the recipient of the following pathetic Lithp: "To Gladyth—with oodlth and oodlth of kitheth,

Ithy.

And some clinging vine—bittersweet, mayhap—had spent hours of labor devising an elaborate greeting to her "cave-man," Mr. A. Strom. "Cave-man" indeed! and he our most distinguished financier and contestant for the Paris Prize! It is awful to examine these outpourings of infatuation.

The last missive in the goodly pile was directed to Mr. John A. Walquist, our long respected president. 'Twas sealed with seven seals, and tied with ribbons galore, portending contents of more than usual interest and value. Mr. Walquist, perhaps suffering a premonition of what the contents would prove to be, tried in vain to evade the pursuit of the curious. After several ineffectual flights he took refuge on the vestibule cupboard, where, amidst helpful suggestions from the eager multitude below, he broke the seven seals, untied the ribbons galore, and slowly unwrapped the mysterious token. Ah-h-h-h!

Within lay a coquettish photograph of one of our more notable notables, namely, Miss Gl——

(Note: The first installment on our hush-money has just been paid by Mr. Walquist. To divulge anything further under these circumstances would be altogether dishonest, we feel; hence pardon our silence on this delicate topic.—Ed.)

Ten Nights in a Drafting Room is scheduled for early release by the Infamous-Players-Spasmodic Corporation. The scenario opens in a City Church, thus identifying it as one of the modern triangle plays, rather than the stupid old-fashioned variety where in the *end* "they were married and lived happily ever afterwards."

The wild night-life of University students is luridly revealed in this startling film; the Sink of Iniquity, brimming with paper pulp, is in full view. The ten knights were chosen by the director by virtue of their long beards and wildness of eye, thus giving a notably realistic touch to the scenes of debauch. Nor is heart interest lacking in this masterly production. The fade-away views of some of these miserable rag-tags of humanity snatching

brief moments of repose on the hard hard desks of the Freshman drafting-room or the softer accommodations elsewhere, is enough to wring pity from the coldest of hearts.

A special orchestral score is being prepared by Olaf Fjelde for the initial performance. Against a background of coughs, groans, nose-blowing, and more coughs, will be heard, *expressivo con molto licenzo*, the plaintive melody of "Four o'Clock in the Morning" with interpolated variations on the theme "Damn! Damn! Damn! the Hours Are Marching!" in a more martial vein.

Passed by the Board of Watchmen, February 24, 1923.

Students of the Department were guests of the Minnesota Chapter of the American Institute of Architects at the initial showing at the Chicago Tribune Competition designs at the Art Institute on the evening of February 15. On Washington's Birthday, a week later, a second special showing took place, when Professor R. C. Jones talked informally on the program of the competition, and the limitations imposed by Chicago zoning laws. Professor Arnal gave a discussion of the designs in general, an analysis of the three prize winning designs, and commented briefly on many others among those entered.

CHEMISTS

FROSH CHEM MEETING.

Sponsoring their first social event the freshman Chemists held a noonday luncheon in the Men's Union, Thursday, Feb. 8. They had as guests Dr. M. C. Sneed, Dr. C. A. Mann, and Mr. R. E. Kirk, all of the Chemistry faculty, and Richard Rademacher, chairman of the Chemistry Student Council. Introduced by the class president, Kenneth Peterson, the guests responded with short talks. The "frosh" were especially delighted with Dr. Mann's talk on study habits.

At a recent business meeting of the class, Howard Woo was named to head the St. Pat's Day committee, and plans are on foot to get up an elaborate float for the parade.

SHADES OF BEETHOVEN!

To the casual spectator the Freshman lab. presents an incongruous symphony. To the incessent, clamorous, dominant melody of voices is added the whir and sputter of noisy Bunsens, the clank and rattle of protesting apparatus, and the smash and crash of shattering glass so pleasant and natural to the Freshmen ear. At appropriate (and frequent) intervals the movement is punctuated by an unkind, disruptive explosion; various bits of glass and other scenic effects rain back upon the storm area, and some hapless Freshman shakily pronounces: "And the next day it rained."

The spectator is also assailed by a symphony of smell. Alcoholic odors, sulphide odors, perfumes reminiscent of Limburger cheese, etheral odors strangle him, engulf him, stifle him.

But an unsymphonic haste seems to grasp the players in this symphony. They are juggling innumerable test tubes of brightly colored solutions, setting up apparatus, heating solutions by means of the sand-bath, testing for unknowns by the deep and intricate process of comparing with the reagents on the shelf, finding an absorbing interest in a certain part of the laboratory near a certain bobbed-haired damsel, and, all in one breath, packing in an inarticulate jargon about the last Radio concert, the time they had last night, and a hundred other illuminating topics.

Finally, Mr. Bakken, the symphony director, invites a few dark conspirators premeditating prematurely to perambulate to enjoy his society yet a little while; then there is a mad crash of apparatus being stowed away; the bell rings, and the symphony is over.

HOW THEY TOPPLED.

The latest reports from the headquarters of the S. C. B. L. (School of Chemistry Bowling League) indicates that the Graduate team headed by R. C. Fuson are in the lead by a huge margin. The standings at the completion of the first round are:

Team	Won	Lost
Fuson's Lions (Grad)	9	0
Rowling's Animal Trainers (Soph)	5	4
Firth's Wildcats (Seniors)	4	4
Fuhrman's Bears (Juniors)	0	9

High total scores:

Seniors	2319
Graduates	2294

High single games:

Peterson	217
Doran	210

High averages:

Anderson (Grad)	170
Doran (Soph)	167
Peterson (Senior)	163
Fuson (Grad)	159
Nygard (Grad)	152

The Juniors, who hold the football and kittenball championships of the school, are praying for spring so that they can atone for their defeats.

PLEBEIAN PUSILLANIMITY

"And you know, I wouldn't dare take Chemistry. You can't tell when something is going to blow up." So spake a fair Co-ed whose greatest danger from this source occurred when she wrote that Rhetoric final in the Chemistry auditorium.

Her fears cannot, however, be classed with the general timidity attributed to the weaker sex. Many a stalwart "ed" also dodges Chemistry because of its supposed dangers.

You who fear Chemistry, tell me: How often do you read in the Trib. about a Chemist being injured through a laboratory explosion? About once in every year containing 54 Sundays, don't you?

And yet it seems to be an inherent trait of all the uninitiated to fear Chemistry. If a chair tumbles over in a room in the Chemistry building, these timid souls begin praying for the one injured in the supposed accident.

While these fears merely amuse the experienced Chemist, yet he views them with some concern, for their expression brings discredit upon their profession.

And so I beeseech you who fear our profession, quell your fears. Your chance of being murdered in 1923 is one in 1200; your chance of dying in an unexpected "blow-up" is one in a million.

CIVILS

A. S. C. E. MEETS

Mr. P. C. Gauger of the Gauger-Korsmo Construction Company was the principal speaker at the regular monthly dinner meeting of the student chapter of A. S. C. E. Mr. Gauger's speech dealt principally with cost estimating, stressing the fact that estimation of values of commodities is too often neglected in a college career. The student graduate has thus been deprived of training in the use of his judgment, the lack of which so often means a failure in the work of a young engineer.

But besides being able to estimate the cost of materials "a graduate must know his own abilities," says Mr. Gauger. "When applying for a job, know what you can do," was the speaker's advice to the seniors.

Prof. O. S. Zelner spoke of the necessity of supporting intramural athletics at Minnesota. Mr. Zelner suggested a plan by which men who take part in class and college athletics would receive letters or sweaters from the classes or colleges which they represent. The expense, thus incurred, would be borne by the treasuries of the various classes.

Mr. Frank Roos "vos der ioo" with his trick hat, and, as was fitting, he emphasized the importance of "religiosity" by impersonating a Nordic parson.

If the producers of the "Blew Gawd" would blow up to Mr. Zelner's Surveying class, they might discover valuable material in the whistling chorus which, thus far, has been having regular rehearsals on Tuesday mornings. It is the opinion of many that this body should be recognized as a campus organization. It is understood that the members are bound by short individual contracts, and therefore they will probably conduct their rehearsals secretly after this. A petition, which would allow the chorus to be excused from class, in order that it could practice, was circulated.

ELECTRICALS

ELECTRICALS WILL ENTERTAIN

Plans are already getting under way for the Electrical party which will be put on some time during the spring quarter. This is a bi-annual affair and has become one of the traditions of the Engineering College. At this time, the laboratory and equipment are turned over to the students and the Building becomes for two days a collection of freak stunts and exhibitions. Many entertaining and instructive features are included as well as many of the most mysterious of the Electrical acts on the stage. The show is a worthy tradition and one that every Electrical should support. The faculty is behind the movement and co-operates to the extent of their ability. The show is put on for two nights and is followed by dancing in the Engineering auditorium. The student branch of the A. I. E. E. is in charge, with Chas. M. Burrill as general chairman.

About fifty couples attended the Junior Engineer's Dance which took place in the Ball Room of the Union on Friday evening, February 9th. Garzen's five-piece orchestra furnished the music, which was well received. The party was given an electrical tinge by the static electricity which snapped from one couple to another as they happened to touch. Everyone present reported a good time, and voiced hopes for more social activity among the Engineers in the near future.

FIRE!!

The calm peace of the electrical building was seriously disturbed on the morning of February 17. The cause was an explosion in Room 4 in the basement, which is used as a machine shop. The shop mechanic, Edward Offstie, was heating a pan of wax over a gas flame. He gave it "too much gas" and the wax became overheated and exploded. The flame was blown out and gas fumes mingled with the thick smoke from the wax. "Eddie" broke out several panes from a window and thereby saved himself from the ill effects of the gas. In doing so, however, he nearly ruined the hero of the affair. Our efficient janitor was the first one on the scene of the explosion. He says that the draft of smoke and gas caused by the broken window nearly knocked him over. He withstood it, however, and turned in a fire alarm. Excitement among students coming from first hour classes was wasted, as nothing burned and no serious damage was done. Upon seeing the fire engines, many expressed the hope that either the mechanical or the electrical buildings would burn down. They offered that method as the quickest way in which to get the much needed new buildings.

FROM THE ELECTRICAL MUSEUM

College of Engineering and Architecture,
Department of Electrical Engineering.
Gentlemen:

I submit herewith my report on your experiment on Armature Winding. This is a subject which I never did know extra well, and on which my meagre knowledge had become so rusty that the renovation supplied by the experiment was distinctly needed.

Respectfully yours,
EDWARD NICKERSON

As the writer was strolling down the street near the post office, he was surprised to see a mass of flames upon the top of the flag staff across from the armory. To satisfy his curiosity he meandered up to the location and asked one of the interested onlookers what was the cause of all the excitement. The facts of the case were that one flag had caught on a nail and necessitated its being burned for removal. The ignition was effected by the hoisting of a bundle of flaming rags. All's well upon the main campus once more as the excitement has died down.

"The slightest suspicion of lack of morality, integrity, honor or loyalty is a complete bar to engineering professional honors. Strict codes of engineering ethics are being adopted by all the great engineering societies and the grafter must be expelled from the profession in disgrace. A man who is not wholly honest might better be working with a shovel than trying to practice engineering."—Anson Marston, dean of engineering of the Iowa State College.

MECHANICALS

The local student section of the American Society of Mechanical Engineers held its annual banquet in the Minnesota Union Ball Room on the evening of February 16, 1923. The banquet was considered a big success by all who attended.

A strictly student program was the main feature of the affair. The presidents of the A. E. S., A. I. E. E., A. S. C. E., and A. S. M. E. were present. A brief address on the activities of their respective sections was given by each president.

The most unique part of the entertainment was the initiation of the Sophomores into full membership. Several musical numbers by the Mechanical Quartet with "Ken" Ross at the piano, and by "Art" Kumm and his banjo, completed the program.

GAS ENGINES BEING BUILT

The Sophomore Mechanicals are working on the production of a number of small gas engines, to be used for motor-boat or canoe propulsion. They are single cylinder, two cycle, horizontal engines: size 2⅝ inches bore by 2½ inches stroke, capable of developing about 2 H. P. at 900 r. p. m. They will run at about 9 H. P. Hours to a gallon of gasoline.

The plans for the engine were originally drawn by Professor Shipley several years ago. Mr. Nilson, instructor in machine shop practice, has altered the design somewhat, and has replaced the former water jacket that was cast as part of the cylinder, by an aluminum jacket. This facilitates molding and machining. All ports are drilled, rather than cored.

AERONAUTICAL CLUB FORMED

A number of students in the Engineering College have formed a new club, the Aeronautical Engineering Club of the University of Minnesota. The club was organized in the College of Engineering on the evening of Tuesday, February 6, 1923. Officers and faculty members were elected and plans for the year were outlined.

The purpose of the club is to promote the study of aeronautical engineering and aerodynamics, and their commercial and engineering applications, and to carry on aeronautical investigations.

Membership is open to students and faculty in the technical colleges of the University, who have a direct interest in aviation. The charter membership is as follows:

Honorary: Dean O. M. Leland.

Faculty: Mr. Charles Boehnlein, Faculty Advisor; Mr. L. M. Becker, Mr. Victor Gauvreau.

Students: John Wagner, Pres., M. E. '24; Paul M. Boyd, Vice Pres., M. E. '24; Clifton C. Rousseau, Sec'y., M. E. '24; George Langford Jr., Treas., M. E. '24; J. A. Anderson, M. E. '24; R. M. Cross, M. E. '24; G. B. Gilbertson, M. E. '25; T. E. Lobeck, E. E. '24; K. R. Ross, M. E. '24.

The members of the club are engaged in the design of a wind tunnel, which will be of great value in the experimental work which is to be performed. The place of installation of the tunnel has not yet been selected. This tunnel, although designed primarily for aeronautical experimentation, need not be limited to this work. It may be used in connection with ventilation apparatus, the determination of the effect of wind on the sides of buildings, and in many other ways.

WATER-BORNE TRANSPORTATION

(Continued from page 14)

obstacle that determined the location of the present great city and harbor of Montreal just below the rapids. Our cargo is now placed in a lake vessel of the "Welland Canal" size, not over 250 feet long and drawing 14 feet of water. Between Montreal and a short distance below Ogdensburg on the St. Lawrence a stretch of about 100 miles, are encountered the series of rapids and the obstacles to deep draft vessels that have been the subject of the recent agitation and investigation with respect to power development and channel improvement. For the present, passage around all these obstructions for vessels not larger than the one here considered is afforded by a succession of side canals and locks lifting our vessel a total of nearly 250 feet to the river level near Ogdensburg. From here up the St. Lawrence and across Lake Ontario, the route is clear to the northern entrance to the Welland Canal. Here is another lift by a series of locks of 320 feet to Lake Erie and then we proceed across that lake and on into Lake Huron through the channels in Detroit River, Lake St. Clair and St. Clair River, which have been deepened in several places artificially to accommodate vessels of 20 feet draft. The mean level of Lake Huron is about eight feet higher than that of Lake Erie, but this drop is so distributed over the connecting channels that no lock is necessary, though there are considerable currents in the lower Detroit River and the upper St. Clair. Once in Lake Huron our lake vessel proceeds to Chicago through the Straits of Mackinac, and the cargo is delivered without change of carrier since it was received aboard at Montreal. By this route also both night and day navigation in all ordinary weather is practicable, and there are practically no overhead obstacles in the way of bridges or otherwise.

To take a brief glance at the water approach to Chicago from the west, this is by way of the Illinois River and the canal system connecting the Illinois with Lake Michigan. The course starts from the Mississippi at an elevation about half way between the level of Lake Ontario and that of Lake Erie and the larger part of the total rise to Lake Michigan is in the upper part of the route, between Joliet and La Salle. This is the locus of the water power development problems. A supplement to this route is by the Hannepin Canal, leading out from Rock Island, a shorter connection with the Mississippi but with less favorable grades and of less capacity. These waterways, while of great importance to Chicago, are given only brief mention for present purposes since they are regarded as already determined by Federal and State legislation and appropriations, though not yet fully completed. They will permit any type of floating carrier likely to be developed for upper Mississippi commerce to come to Chicago.

For the immediate vicinity of Chicago, we will only note the many unusually favorable conditions afforded by nature for harbor facilities—basins, channels and railway terminals, and for the ready interchange of all kinds of traffic among deep draft lake vessels, boats of the canal barge type, river boats, and railways—we are now prepared to take a

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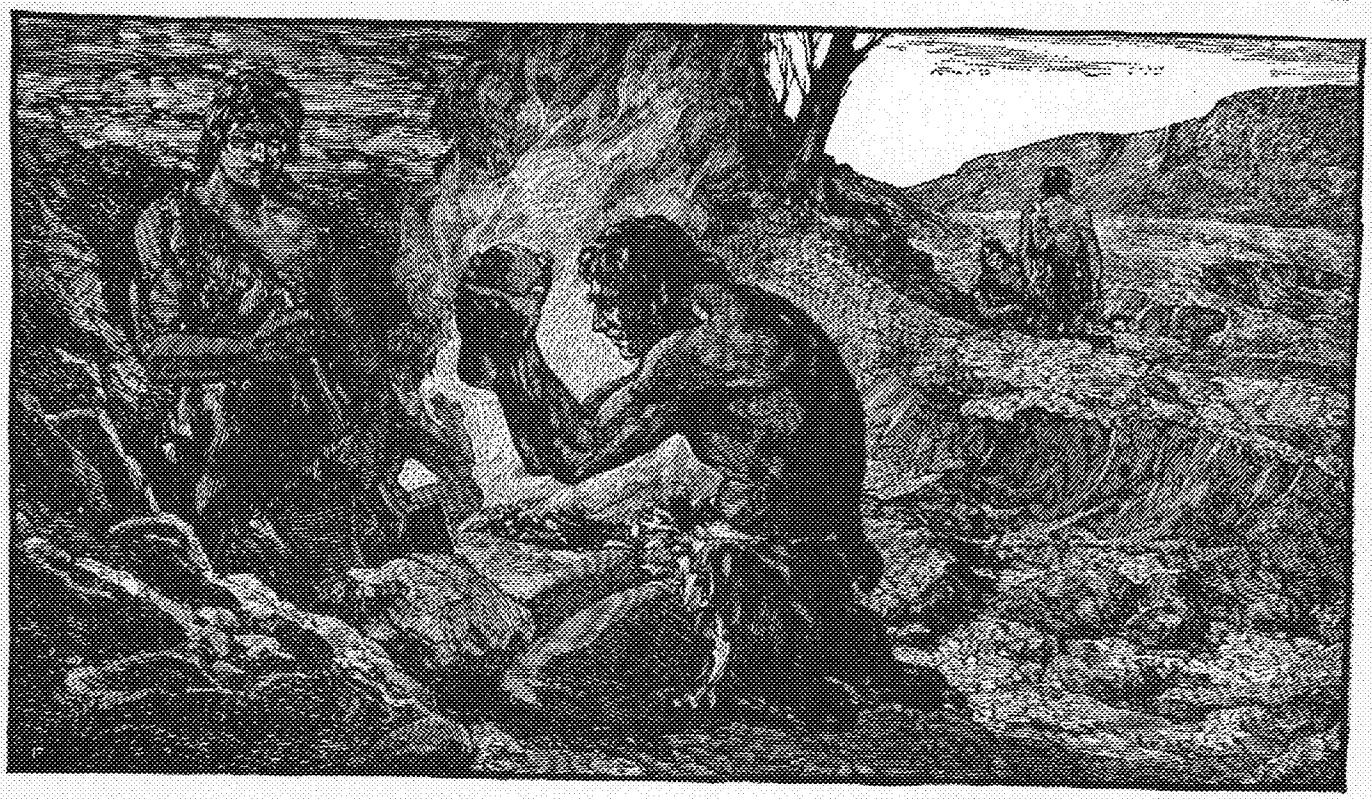
somewhat comprehensive or generalized view of the condition outlined in their inter-relations and as to their needed and probable future development.

Looking to the south and west we see Chicago with assured water approaches practicable for any pattern of vessel that may come into practical use for the system of the upper Mississippi River and its tributaries, though an exception must be noted of the coal barges when moving in great fleets as they do down the Ohio.

Looking to the north and east, however, we see certain serious limitations for water-borne transportation to and from Chicago. Inland water craft from the west and south can go no farther than this port. Barges of the New York Canal type can approach no nearer than Toledo without such risks from weather conditions on the open lakes, where the intervals between harbors are so great as to make this prohibitive. If we assume the Maumee River canalized and developed for power, still the barges could not get nearer than Fort Wayne, which is at the head of the ancient Wabash outlet channel from Lake Erie, the counterpart of the one leading from Lake Michigan to the upper Illinois now followed by the drainage canal. This limit is as far from Chicago as Albany is from the sea at New York and it is about 100 miles from Lake Michigan at either Michigan City or St. Joseph-Benton Harbor. Vessels of the regular seagoing type cannot approach from either New York or Montreal, but if we imagine a seagoing vessel departing from the harbor at Chicago, it could easily go as far as Port Huron at the outlet of Lake Huron but no farther if it drew more than 20 feet of water. However, if it could go through the 20-foot channels from Lake Michigan to Lake Erie, as many of the smaller vessels operating on salt water can, the new Welland Canal, now under construction, would enable it to reach the rapids section of the St. Lawrence, but there it would have to stop on account of deficient depth and lock dimensions in the existing side canals around these several rapids, now limited to a depth of 14 feet.

Looking at our immediate surroundings we see, in addition to the terminal and transfer possibilities above referred to, that this is the focus or radiant for an unexampled railroad transportation net covering practically the entire area that the water transport lines can serve and much more, and extending to the seaboard wherever they do. In few words, the possibilities for purely local transportation facilities need give us no special concern. Connections with the south and west by river and canal transport are assured, but with a channel limited to a depth of eight feet at present. The most direct contact possible with all lake navigation proper as this is now developed or as it is likely to be improved and expended in the future already exists. The main handicaps are that barges of the Erie Canal type cannot actually come nearer to Chicago than Toledo, or say theoretically, Fort Wayne, 100 land miles away, and that vessels adapted to sea navigation cannot go farther from Chicago than Ogdensburg on the St. Lawrence, 100 miles short of tidewater at Montreal. Even with the Maumee River improved and developed, which has not yet been provided for but which power demands may possibly lead to some day, there would therefore still be

(Continued on page 24)



America's First Miners

When the mammoth and the mastodon grazed in the vast places of our early country, prehistoric men were busy pounding shiny fragments of native copper from their rock settings on the southern shores of Lake Superior.

These miners of the Stone Age first built fires to disintegrate the harder rocks, then they pounded out their treasures. Hammers of diorite or porphyry, shaped by the waters of the lake or by hand, occasionally grooved and fitted with a handle; wedges made of the very substance they were mining and tempered by the pounding that fashioned them; shovels of cedar that were used only as scrapers; bailers of bark or carved wood —these were the tools used in their open pit mines.

Now, whole mountains are removed to obtain copper; 47,000 tons of copper ore have been mined in a single day at one mine with the aid of Hercules Explosives. The principal problem of today is not the mining of the metals, it is the elimination of waste in their production.

We have for years recommended Hercules Special No. 1 because of its higher cartridge count and lower cost per cartridge in comparison with the dynamites in general use. No high explosive on the market is more economical.

For further details write to our Advertising Department, 939 King Street, Wilmington, Delaware, for our booklet "Volume vs. Weight"—A lesson in explosives economy.

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Pottsville, Pa.
St. Louis, Mo.
Salt Lake City, Utah
San Francisco, Cal.
Wilkesbarre, Pa.
Wilmington, Del.

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100 miles of land barrier between Chicago and the sea for possible barge traffic, as there is also still about 100 miles of obstruction to the larger lake vessels and smaller ocean ships just above Montreal. An incidental circumstance is the widespread and urgent demand for increasing the capacity of the railway transportation system which traverses all this region, and for reducing the cost of rail carriage.

Only a word is necessary as to the need for transportation facilities of the highest efficiency throughout the area referred to, the most populous and the most active in all the United States and Canadian territory: For the great food producing area of the middle west and the northwest, the ore beds at the head of Lake Superior, the coal deposits of the Ohio River valley and its upper tributaries, and the manufacturing and agricultural industries distributed throughout the entire region; not to mention the timber products which, while diminishing, are still important.

The project for a barge waterway between Toledo and Chicago in connection with proposed enlargement of the old Miami canal connecting Toledo with Cincinnati has recently been re-examined by a board of engineers, but the report is not yet available. As is well known the project for an enlarged channel and power development between Montreal and Lake Ontario and for enlarged channel alone connecting Lake Ontario and Lake Erie has been the subject of extensive investigation by the International Joint Commission and their report and recommendations are now before the respective governments. These recommendations contemplate a depth for the channels at first of 25 feet with provision for an ultimate depth of 30 feet, but the engineering features and plans are to be subject to further study before final determination.

It may here be offered as an individual view that one feature which affects all water transportation to and from Chicago as well as everywhere else, and one which has not yet been appreciated at its full value, is that of the **adaptation of the vehicle conditions of the roadway.** If adaptation were strictly carried out on a physical basis alone, we would have a special vessel for the Hudson, another for the New York Canal route proper, a third for Lake Erie, and perhaps a fourth for the greater lakes. Likewise ocean-going ships would come up the wide estuary of the lower St. Lawrence to Montreal only, and there transfer to a vessel especially designed for the conditions of the upper river, including the chances of encountering ice, with perhaps another change on entering Lake Ontario, and in all these cases, each type of boat would be kept exclusively occupied at the service for which it was best fitted. The specialized vessels for the lake traffic exclusively that have already been developed to such perfection are well known. By an extreme application of the same principle of specializing the carrier, there would be ocean vessels stopping at the passes of the Mississippi, at the Chesapeake capes, and at the Delaware capes, instead of going on to New Orleans, to Baltimore, and to Philadelphia, respectively. It is not alone a question of how far inland a vessel **can** go but how far it will pay to take her, and when a limit of distance has been reached beyond which some other mode of transport is more advantageous, as will be demonstrated by somebody

Simple economic conditions, like costs of handling and transferring freight, expense of vessel operation and maintenance, insurance, etc., determine all these things, but **never with absolute finality,** since the adjustment is always subject to change with changes in the factors that are constantly in progress.

The problem of the St. Lawrence development may be regarded as determined for the present by the commission's exhaustive report, so far as this can be determined until affirmative action by the two governments may be taken. But the realization of this undertaking will at best require several years. The enlarged New York canal system was 13 years in the building with an outlay two-thirds as great as the estimate for the St. Lawrence project and with no international questions to complicate the enterprise. Though this is now completed so as to be available for business, it has not yet begun to function as a really important factor of the transportation systems of the country. Self-propelled cargo barges of near the limits of New York canal lock dimensions in size have been built and five of these vessels made the trip from Duluth to New York last summer, but their complete economic success is still to be demonstrated.

But we **have** the New York canal, and the Great Lakes with their connecting channels and harbors, the latter limited to a 20-foot draft, and we **have** the great railroad net and the rapidly developing state highway systems—and we have not yet got the St. Lawrence waterway. Meanwhile we must go on doing business under these conditions till this outlet and inlet may be provided. Let us get it if this is practicable, and as soon as practicable, but **we cannot afford to sit down and wait for it.**

A concise summing up may now be made of the immediate problems which seem to the writer as appealing to engineers and economists in connection with the general transportation facilities affecting Chicago and the country.

(A) Placing the railroads and all existing terminal and transfer plants and appliances and all facilities and appurtenances of the lake harbors in the highest possible state of operative efficiency.

(B) Getting the greatest possible returns from the inland waterways **as they are,** or as they are already provided for. This, of course, includes the New York State canal system, and the pressing need for this latter is the development of a type of carrier and a method of propulsion which will speed up the general freight movement, and which will enable the canal boats to go on from New York through sheltered channels east and south, and which will remove the necessity when westward bound of stopping and transferring all freight at Buffalo. Improvements in the systematic operation of freight service on the canals are also much needed, but these will come with experience. If canal barges ever can come west of Toledo to Lake Michigan by way of Fort Wayne, the inland waterborne traffic from the west of Chicago will have the way open to the eastward, at least to Toledo and Detroit. Otherwise this traffic must stop here and transfer to rail, to lake vessel, or perhaps at some time in future to ocean-going ships. It must be recognized that Detroit and Toledo just now have a more favorable outlook for a possible Lake-Canal

The Engineering in a Curling Iron

What sort of engineering is it that makes a study of the needs and the interests of women and creates products to satisfy them? Does it seem that, in practice at least, this sort of thing is a little different from your understanding of what an engineer really is and does?

After all, when you come to think of it, engineering is concerned with all the facts of life. It takes the old facts and interprets them in new and broader ways; but its big job is the very big job of making more living, —fuller living,—readily available. It is, in every aspect, a thing worth doing, whether it concerns itself with curling irons or converters, or any of the thousands of products in between.

This is truly the day of the engineer. His judgments and his equipment are sought in almost every phase of living. Engineering is remaking the business of housekeeping. Its methods are being applied to merchandising, to distribution, to the wrapping of bundles and the packing of boxes, to the lighting of streets and the hundreds of things that, a few years back, were strictly "rule-of-thumb". By the time you are at work out in the world, there will be more—though there are only a few of them left.

Whatever is worth doing is worth engineering; engineering effort dignifies itself. Whether it puts more usefulness into transformers or curling irons or turbines does not matter. The thing that counts is the work, the creative, constructive service that is going on for the lasting benefit of mankind.

NORTHERN STATES POWER TO EXPAND

The student branch of the American Institute of Electrical Engineers met in the Minnesota Union Wednesday, February 14. Mr. Crocker of the Northern States Power Co. was the principal speaker, his subject being the $80,000,000.00 project of that company. This is a ten year construction program and at first glance seems to be a sum beyond belief. The fact is, that the Northern States Power Co. has been spending between four and five million dollars annually in the normal development, so that this eighty million dollar program will call for about twice the past rate of increase in capital. There was also a psychological reason for the announcement of the program at this time. Business conditions are largely a matter of the attitude people have towards the future. If they are pessimistic and are expecting hard times, hard times will inevitably result; whereas if they are optimistic, expect good times, they will begin to spend. A little money will start to circulate and the result is that the times are better. We now seem to be emerging from the period of depression in the cycle and the announcement of a construction program of such magnitude will be a great help to restoring better conditions.

The average business is of such a nature that it turns its capital twice a year, or more in many cases. In the utilities business, however, the company turns over its capital about once in four years. This is the reason that any sort of development runs into such big figures.

The plan includes the development of several water power projects. The power from water runs from 10% to 90% of the output during the year and averages 45% for the whole year. The water plants usually have to take the power as it comes, and rely on the steam plants to take care of the fluctuations in the load and carry the peak. On the Kettle river, however, the company will have a system of reservoirs and dams whereby the water flow may be regulated and released as the peak load comes on. The water from the Kettle river will be utilized in three steps.

Mr. Crocker also spoke of some of the big problems in the power game, mentioning especially the small consumer and the farmer. There is one concern in Minneapolis that buys more power than all the resident consumers combined. It is obvious that the man who requires only one transformer bank and one meter can be supplied with power a whole lot cheaper than the 70,000 small users, each of whom requires separate transformers and meters. The problem of supplying the farmers is difficult because of the large losses which are inevitable in the transformers.

ENGINEERS' DAY ELECTION

The junior class this year has shown good judgment in electing to the office of Chairman of Engineers' Day, Stuart V. Willson. "Stew" is a good man for the job, being a hard and consistent worker, and is expected to put the "affair" across in fine style. He is enrolled in the Department of Mechanical Engineering.

ARABS BEGIN WORK ON "THE BLUE GOD"

The University of Minnesota, sighing politely over the successive courses of deep-dyed plotting and light melodrama dished up yearly by various campus dramatic clubs, asked for Musical Comedy. She got it—in the Arab Musical Comedy Club. When it comes to starting big things there's only one source of power equal to the task—the Engineers—and the annals of Minnesota will never cease to mark in blue print the great day when the Arabs did the impossible; organized over night, and astounded the gasping public with a play such as was never before thought possible for students to produce. It was typical of Engineering feats.

For the unmistakable success of the first attempt, we bow in homage to our last year's sponsor, Ralph Hammett, now called to larger fields, who accomplished the miraculous task of putting two and two together whenever four was needed. This year three men will try to take his place—impossible, of course, but they might do part of his work.

As a Musical Comedy Club, the Arabs seek to accomplish two great tasks: that of placing musical productions in their rightful rank on the campus, and that of revealing the various artists now in our midst who are hiding behind slide rules and brief cases. It is surprising how much talent we have and how little we see. In the Caliph of Colynos, the thousands who filled the dark Armory saw the artistry and color of India portrayed in a manner and setting that carried them far beyond the dusky brick walls—but that was only a starter. Never satisfied, the Club has assumed a new ambition, in this instance decidedly far-eastern in its aspect, and when spring blossoms out with its year's greatest play, we shall close our eyes and breathe the fragrance of oriental flower gardens, and sway to the mystic music of dreamy China.

The facilities for producing meritorious work have been vastly increased over last year. Al Homer, writer of songs internationally famous, is assisting with the music, in addition to Samuel Sutherland and Frank Christlieb. The capable pen of Glanville Smith is turning out the manuscript. Mr. Earle Killeen, director of the University Chorus, will assist in the musical training, while Prof. Carlyle Scott, of the music department, has placed every convenience of the music school at our command. Several well-known coaching experts are being considered for Mentor-in-chief. In addition to all this backing, plus the united support of the finest faculty that ever breathed true to Engineering tradition and loyalty, we have scores of specialists, pledged to devote their time to us. Orchestral artists, who are developing one of the finest orchestras presented to campus music lovers; chemical wizards who will create effects hitherto unattempted in lighting and specialty acts; experts in design and painting, from whom will come gorgeous settings of rare beauty and reality; and costumers of experience, capable of authentic character representation.

The membership of the Arabs has grown, and richly too. By admitting, in addition to those capable of acting, musicians, and specialists along contributing lines, the club feels that it has strength unlimited.

A NEW CALENDAR

(Continued from page 9)

fourth floor of the Engineering building. The building is decorated by architectural students, who exhibit much of their work in design.

Stuart V. Willson was chosen by this year's junior class as general chairman of the celebration, and he already has appointed his executive committee and arrangements for the greatest celebration in the history of the school are being made. It is expected that the change of date, which prevents interference with final exams and promises more favorable weather, will serve to brighten the celebration.

The list of committees:

Assistant General Chairman—Harley Langman.

Finance—Walter Wilson, Chairman; Loyd Grobel, Phil Berquist, Art. Tewes, Al. Furman.

Dansant—Chas. Rhenstroni, Chairman; M. Nelson, C. Teal, Einer Nelson, Geo. Langford.

Publicity—Clarence Volz, Chairman; J. W. Silverman, G. Bodin, Frank Roos.

Decoration—Chas. Skarolid, Chairman; Wallace Bousall, William Woollett, Dean Rankin.

Green Tea—Adeline Feig, Chairman; Gertrude Humphrey, Helen McGregor, Lawrence Tvedt, Homer Tatham.

Parade—John Moore, Chairman; George Berry, Arthur Olson, Lyle McLeland, A. Anderson.

Hall—C. Chapin, Chairman; Julian Garzon, Mac Keneth, Glen Westegard, C. Rosseau, L. Mabbot.

Open House—A. T. Miller, Chairman; A. Saltivich, Clarence Westegard, C. R. Bodget, Paul Boyd.

Knighting—John Wagner, Chairman; Ed. Koehler, H. Leise, Arthur Peterson, Frank Kiesner.

ALL-'U' FRESHMAN YEAR

(Continued from page 10)

versity at any one time under this system, still this item might not be as great as it would appear at first glance.

It could not be said that the addition of an all-freshmen year to the university system would add a whole year to the average time spent by a student at the university. As stated earlier, at present much time is lost through the inability of the student to choose the proper course when he enters the university. The introduction of the all-freshmen year would act as a sort of insurance against time wasted in pursuit of courses not suited to the field which the student eventually enters, and would give in addition a broader view of the problems of life in general and make the student better fitted to render the service that is expected of him when he leaves school as a graduate of the institution.

Formal exercises were recently held to commemorate the opening of the paved highway connecting Danville and Champaign. The contract called for thirteen miles of pavement and nine miles were laid during the past season. The pavement is seven inches thick and eighteen feet wide, divided longitudinally in the center, the two halves being held together by dowel bars. The edges of the pavement are reinforced with longitudinal steel rods, according to the requirements of the Illinois State Division of Highways.—*The Technograph*

ALUMNI NEWS

(Continued from page 13)

Up to the present they have had 145 inches of snow and expect as much more before winter is over; 5° above is the coldest it has been. It very seldom gets below zero. No. 61 is one of the upper camps; about 400 men work here. They have a large hospital here and is sort of division headquarters for the upper camps. Mail comes every day, by six horse team and sled when the trail is open and by dog team otherwise.

They have movies here once a week. They show them in the mess hall and if you are fortunate enough to find a seat and can stand the mixture of tobacco smoke, wet clothes and stale air, you are able to enjoy it.

The scenery is beautiful around here. We are right in the midst of big pines, while off to the north large peaks rear up way above the timber line—the Jackass Country, as it is called here.

In some ways it reminds me of the camp up north, yet it is far different. Anyway the appetite is enormous, the air couldn't be any purer and you are out in the open. That's what I enjoy. I will send some pictures sometime, they might be interesting.

Give my regards to any of the old gang. I am going to write to Les Halliday at the house in a few days.

Sincerely yours,

HAROLD BARBER.

Big Creek, California,
Edison Camp No. 61.

SPORTS

(Continued from page 15)

major sport. Director Luehring holds this view, and at a recent meeting of the "M" club, a resolution was passed without a dissenting voice, recommending to the Senate Committee the recognition of hockey as a major sport and the awarding of major letters to this year's team.

SWIMMING

That the path to glory is beset with many a pitfall was the hard lesson that the all-conquering Gopher swimming team was forced to learn when they tangled with the powerful Northwestern aggregation in Patten pool, the home of the Northwestern fish. The evening started badly when the relay team suffered its first defeat by a 3-foot margin, but some hope shone through the dark clouds when Gow, stellar Gopher, swam the famed Breyer to a standstill when they tangled as anchor men on the respective teams. The remainder of the events followed the dope, giving the Gophers a 27-23 lead before the backstroke event, where the dope spilled badly. Day and Holmes, expected to take first and second for the Gophers, were off form and finished third and fourth. Northwestern won the meet by a 37-31 count.

Minnesota and Northwestern will battle out the conference supremacy at the Conference meet in Bartlett pool, Chicago, on March 15 and 16. The dope does not give either team a decided edge, but the Gophers feel that, given a neutral tank, an even break, and the fight that they will supply, that another championship will come to roost at Minnesota after the spray has settled.

TECHNICALITIES

TOO LITERAL.

John—"I hear Bill was kicked off the squad."

Jack—"How so?"

John—"He was told to tackle the dummy, and he tackled the coach."

—Virginia Reel.

"A certain academic was overheard telling his girl that a slip-stick was a new cosmetic."

A cycling "nut" was riding along when his hat blew off. A passing countryman picked it up and took it to him as he circled around, saving him the trouble of getting off his machine.

"I weally must get some thwing to keep this bally hat on," muttered the "nut" as he wheeled off without a word of thanks.

The yokel's reply was short but expressive—"Get a nail, guv-nor."

—Pearson's Weekly.

It has been rumored that nitrogen is unable to support his wife, combustion.

First Co-ed—"Gosh, my laundry bill is $4.68 this week."

Second Ditto—"That's awful. Mine was only $1.03."

First—"Yes, but you don't go with an engineer."

—The Black Hills Engineer.

Scab—"How many men do you have working here?"

Boss—"Oh, about half of them."

A "drunk" approached a man dressed in a Salvation Army Uniform in St. Paul one evening. "I shay bosh, wha' army d'sh you belong to, hic?"

S. A. Man—"To the army of the Kingdom of Heaven."

Drunk—"You ish a long way from sh' barracks, old top."

"Say, waiter, this stew is the bunk."

"Well, drag him out then."

Paying alimony is like buying oats for a dead horse.

Ad in the "Cleveland Tribune"—"The ladies of the Helping Hand Society of the ——— Street Church, have discarded clothes of all kinds. Call at the vestry room of the Church and see them."

She—"Were you ever pinched for going too fast?"

He—"No, but I've been slapped."

"Buy a Ford, and Save the Difference," for spare parts.

Freshman—"You surely are a good dancer."

Co-ed—"Thank you. I'm sorry I can't return the compliment."

Freshman—"You could if you were as big a liar as I am."

Traveler—"Do you call this a fast train?"

Proud Conductor—"Yes, sir."

Traveler—"Do you mind if I get off to see what it is fast to?"

—Judge.

THE OILY BOID.

A.—Has anyone seen Pete?

B.—Pete whom?

A.—Pet-roleum.

B.—Kero-sine him yesterday, but he hasn't ben-zine since.

—The Rose Technic.

Soph (at lab)—"Say, instructor, the gas is leaking out of this tank."

Busy Instructor—"And you come to me about it? Get some putty and plug it up. Use your head, boy, use your head."

This page is dedicated to the Dumbells like—

The ham that asked the stenographer for a quilt for the engine bed.

And who thinks butt plates were made to sit on.

And who thinks Bull Montana is a mining town.

(Apologies to the Wisconsin Engineer.)

To be a college bred means a four-year loaf, requiring a great deal of dough, as well as lots of crust.

—The Rose Technic.

Sign in front of a tobacco factory: "Wanted, a girl to strip."

—Boll Weevil.

BETTER LIGHTING NEEDED IN INDUSTRIAL PLANTS.

In a paper read before the Illuminating Engineering Society, February, 1920, entitled, "A Survey of Industrial Lighting in Fifteen States," R. O. Eastman submitted some very interesting data regarding the lighting conditions in industrial institutions. The survey comprises some 446 institutions, in which lighting was considered by 55.4% as being vitally important, and by 31.6% as being moderately important, and by 13% as being of little importance. Practically 58% considered that lighting was as important as power in the operation of the plant, and a small proportion would give more attention to lighting than to anything else.

In considering the present condition of lighting as found in the various plants, only 9% ranked as excellent, about ½ ranked as good, 29% fair, 18.8% poor, 3.5% very poor, and 7.8% partly good and partly poor. It was found that the lighting in the offices was far superior to that in the shops; 19% being excellent, 36% good, 31% fair, and only 13% poor and none very poor.

On consulting the executives regarding what factors were most important in considering lighting, the following facts were revealed: Increase of production 79.4%, decrease of spoilage 71.1%, prevention of accidents 59.5%, improvement of good discipline 51.2%, and improvement of hygienic conditions 41.4%. Manufacturers who have good lighting appreciated its value largely from the standpoint of its stimulating effect upon output.

There is no question that any intelligent man who carefully considers the necessity for good lighting in an industrial plant, will agree that it is impossible for a person to do as good work, either in quality or quantity, in poor light as in good light, but yet the result of a careful analysis discloses the fact that only about 40% of industrial plants are furnishing good light to their workers and 60% are operating under poor lighting. It is hard to understand why such a proportion of concerns can be satisfied with a condition which is universally admitted to be a curtailer of efficiency and a prolific causer of accidents. The principal cause of this condition is that those in charge of such establishments have not given the attention to lighting that it demands. They do not know what constitutes good lighting, and in their absorbing interest of other factors of production have overlooked a vital one.

Every safety official should deeply interest himself in the lighting of his plant and insist upon good lighting as much as good goggles, good guards and other necessary accident prevention equipment. Every production manager should insist upon good lighting because the efficiency of the working force is increased by the condition of the lighting furnished. The plant physician should examine the lighting, for eye strain and eye fatigue are directly affected by poor lighting, as is the hygienic condition. Well lighted plants are invariably cleaner than poor lighted places. Plants equipped with Factrolite Glass in all windows are well lighted.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.,

220 Fifth Avenue,

St. Louis. New York. Chicago.

IN TWENTY-FIVE YEARS

(Continued from page 5)

diminish. But coal is far from an ideal fuel for domestic use and moreover we can ill afford to burn raw bituminous coal and suffer the vast damage to health and property which accompanies the smoke nuisance when, as Prof. S. W. Parr and others tell us, it can be made smokeless by low temperature distillation and at the same time yield valuable by-products of gas and fuel oil. There are a number of researches in this field going on in the United States and the British Fuel Research Board gives definite figures regarding its possibilities. The opinion was expressed at a recent convention of the American Gas Association, that the building of central stations supplying gas for heating to areas as great as some of our smaller states was a possibility not far distant. It was stated further that large interests are planning the adoption of a process for producing cheap fuel gas in at least thirty-five of the principal cities of the country. Plans were announced at this convention for making Denver the first all-gas city in the world. This winter, gas is being used for heating in 100 buildings there and the data acquired from the study of these installations will be the basis of a wholesale effort to substitute gas for coal in Denver. Floyd W. Parsons predicts the use of gas to the exclusion of other fuels and pictures the location of carbonizing plants near the mines with long distance pipe line transmission. A prominent French fuel authority has gone so far as to advocate legal measures prohibiting the use of raw solid fuel for any purpose.

RUSTING OF STRUCTURES

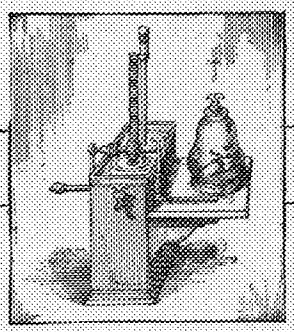
(Continued from page 6)

ing the great rust tax is to specify commercially pure iron when purchasing. By analysis such material should show **less than one-fifth of one per cent of impurities such as carbon, manganese, sulphur,**

Old St. Thomas Church, Durban, South Africa. Nearly 70 Years Old.
Rust producing elements are low. Material is typical of the old fashioned charcoal iron.

phosphorus, silicon, copper and the gases, oxygen, nitrogen and hydrogen. Such material will cost a small percentage more in purchase price, because of the greater care and skill employed in the manufacturing process and also the greater cost of pure raw materials from which the iron is made, but in the long run it will cost less and reduce each one's share

ROBERT BOYLE'S



AIR — PUMP

The "*PRACTICAL*" Alchemist *and* "*THEORETICAL*" Robert Boyle

THE alchemists wrote vaguely of "fluids" and "principles." Copper was potentially silver. Rid it of its red color and the "principle" of silver would assert itself, so that silver would remain. With a certain amount of philosopher's stone (itself a mysterious "principle") a base metal could be converted into a quantity of gold a million times as great.

This all sounded so "practical" that Kings listened credulously, but the only tangible result was that they were enriched with much bogus gold.

Scientific theorists like Robert Boyle (1627-1691) proved more "practical" by testing matter, discovering its composition and then drawing scientific conclusions that could thereafter be usefully and honestly applied. Alchemists conjectured and died; he experimented and lived.

Using the air pump Boyle undertook a "theoretical" but scientific experimental study of the atmosphere and discovered that it had a "spring" in it, or in other words that it could expand. He also established the connection between the boiling point of water and atmospheric pressure, a very "theoretical" discovery in his day but one which every steam engineer now applies.

He was the first to use the term "analysis" in the modern chemical sense, the first to define an element as a body which cannot be subdivided and from which compounds can be reconstituted.

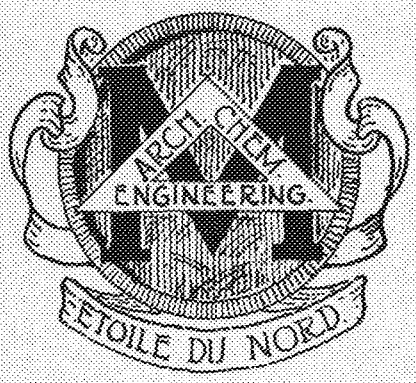
Boyle's work has not ended. Today in the Research Laboratories of the General Electric Company it is being continued. Much light has there been shed on the chemical reactions that occur in a vessel in which a nearly perfect vacuum has been produced. One practical result of this work is the vacuum tube which plays an essential part in radio work and roentgenology.

General Electric

General Office **Company** *Schenectady, N.Y.*

95-602D

MINNESOTA TECHNO-LOG



Saint Patrick's Day Celebration

10 to 12:30 A. M. . . . . OPEN HOUSE
All Departments Will Exhibit Samples of Their Work

12:30 P. M. . . . . PARADE

2:30 to 3:30 P. M. . . . . KNIGHTING CEREMONY
Main Floor, Experimental Engineering Bldg.

3:30 to 6 P. M. . . . . GREEN TEA DANSANT
Engineering Auditorium, Third Floor, Main Engineering Building

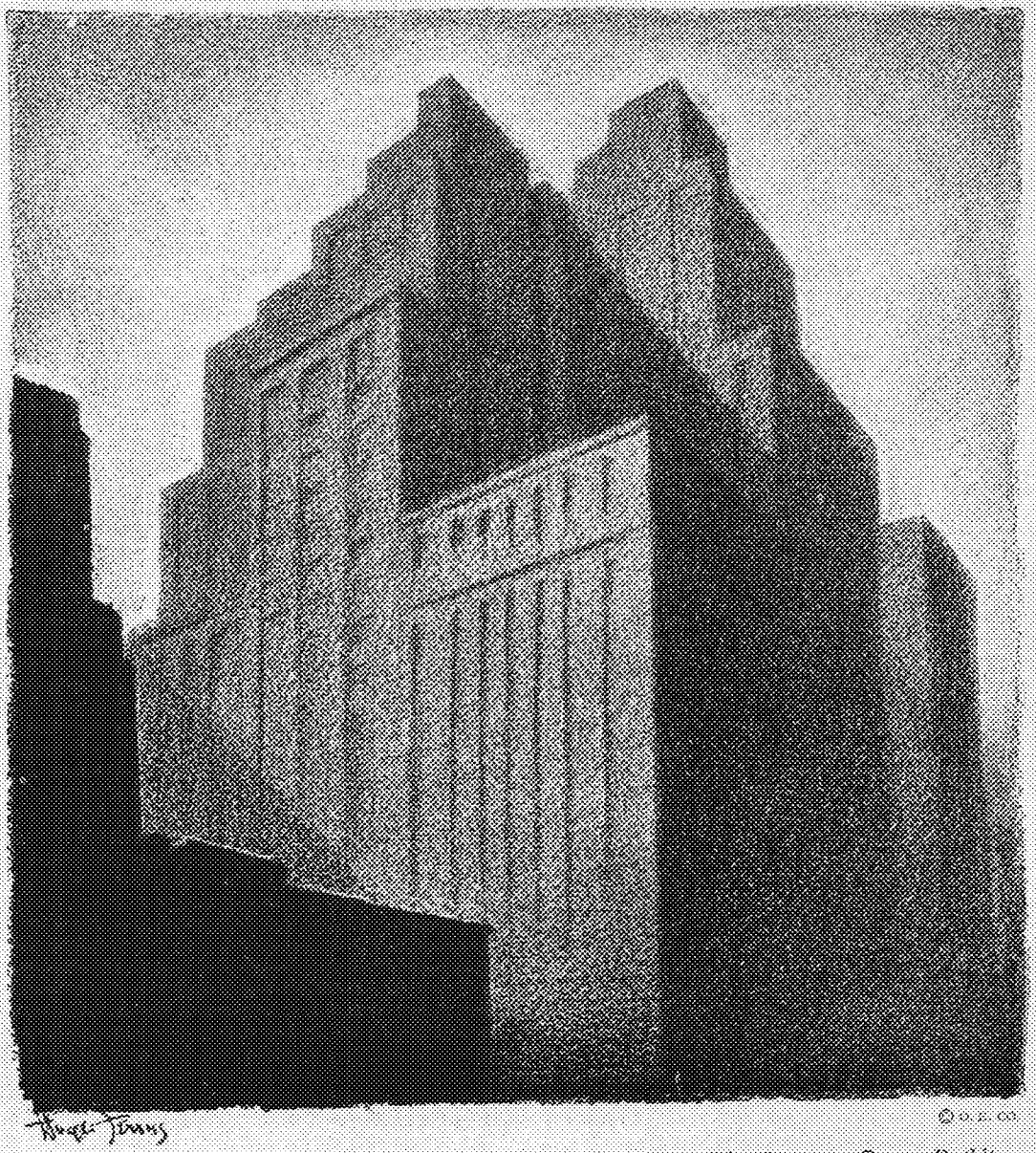
9 P. M. . . . . ENGINEERS' DAY BALL
Armory

APRIL 1923

PUBLISHED MONTHLY DURING THE SCHOOL YEAR BY THE STUDENTS OF THE COLLEGE OF ENGINEERING AND ARCHITECTURE AND THE SCHOOL OF CHEMISTRY.

VOL. III UNIVERSITY OF MINNESOTA NO. 6

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED



The Garment Center Buildings
New York City
WALTER M. MASON, Architect
Drawn by Hugh Ferriss

"Towering Masses"

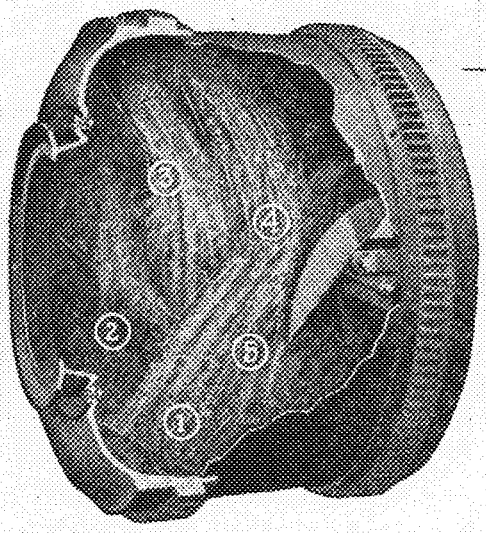
HERE the new architecture expresses itself in great vigorous masses which climb upward into the sky with a pyramidal profile—gigantic, irregular, arresting. An earlier, conventional building on the near corner is overshadowed, engulfed in towering masses of the newer building which are propheric of an architecture of the future which is vividly stimulating to the imagination.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

O T I S E L E V A T O R C O M P A N Y
Offices in all the Principal Cities of the World

WHENEVER YOU BUY

Test the Materials and then—



(1) Blade cuts through materials with churning action. (2) Blade carries materials up, spilling down again against motion of drum. (3) Materials hurled across diameter of drum. (4) Materials elevated to drum top and cascaded down to reversed discharge chute which (5) with scattering, spraying action, showers materials back to charging side for repeated trips through mixing process.

—remember that it depends on the mixer to combine the raw materials, aggregate cement and water into concrete that actually possesses the latent strength of the materials.

That is why Koehring-mixed concrete is Dominant Strength Concrete—because the five action remixing principle prevents separation of aggregates according to size, coats every particle of aggregate thoroughly with cement, and delivers uniform concrete to the last shovelful of every batch.

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INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

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VOLUME III — APRIL, 1923 — NUMBER 6

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MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME III APRIL, 1923 NUMBER 6

'TERRIBLY INTIMATE PORTRAITS.'

Or, "The Mirrors of Church Street."—Being Four Letters Relative to St. Pat's Day

By Glanville W. Smith

The first from a Freshman to a sweet young thing back in the old home town; the second from a Sophomore to his grandparents; the third from a Junior to his kid brother; and the fourth from a Senior to a friend doing post-graduate work at an eastern university.

The First Letter:

(From a Freshman to the sweet young thing back in the old home town.)

Dear Genevieve:

Mother writes that you looked so cute in your booth at the Methodist sale last week, and I sure wish I had been there to buy some pinochy from you. Did you sell much? I suppose that that Dudley was hanging around your booth most of the time, he thinks that now he has those Toridore pants that nothing is too good for him. I could see that when I was home Easter.

Perhaps you noticed in the paper about the big time we Engineers here at the University had on Saint Pat's Day, Friday, the 13th. Some time, I'll say, and work! O the bees' knees, there was plenty of work. Some of us more important members of the Freshmen class got together and just about planned the parade, perhaps you saw some pictures of it in the paper. It takes the inteligentsia to do things here at college, I tell you, Genevieve. Some of the upper classmen told us what to do, but of course we planned out all the details. We arranged things in our math sections. Of course I got elected chairman in my section, because they all thought I'd probably have the best ideas. I didn't want the job, of course, and I said so, but I had to take it, of course. It wasn't any easy job, either, I can tell you, Genevieve, because my math section is an awful bunch of dumbells. You see, everybody in it flunked "trig" last quarter and is having to take it over again. But I was elected chairman, and tried to do the best I could with such poor material.

The general committee was supposed to provide us with a truck if we wanted a float, and paint, and cloth for signs, and such stuff. We were supposed to do something funny if possible—some kind of a take-off on the profs or the Epidemics, or styles, or the P. O. on the Track, or something like that. When one of the members of the committee and I were conferring about our stunt I suggested that it would be a good one to make a couple of great big dice—say about one foot square—and roll them in regular style on a sheet of tin or something on our float that would make a "helluva" lot of noise. But he said that they'd pulled that stunt every year since Saint Patrick first landed on the Campus, so we better think of something else. So we finally cooked up a scheme like this: we'd have kind of a Pirate Scene, with Captain Kidd sitting on top of the cab of the truck, and having a high old time with his cronies down below—the Oak Tree, the Special Sandwitch Shop, Perines, the Yellow Lantern, all of them you see being kind of incriminated as robbers with Captain Kidd. The man from the committee said he guessed it was all right. So we went ahead. I certainly did work hard on that stunt—painted the signs (we wanted the Epidemics and Dents to catch the symbolism, you understand), got pins, lip-stick, and all that kind of mess.

When the Big Day came we had a wild time, I tell you, Genevieve. They were having Open House in all of the buildings, giving away suviners to the visitors, and all that, and all the engines and tanks, and electrical apparatus going full speed, so it was hard to find a place for us to dress. But we did, and the pins were necessary every one, I tell you Genevieve. I was the Oak Tree, dressed up like a maid with a black dress and white apern.

But misfortune laid in wait for Captain Kidd and his gang, for, when we came down one of the men on the committee came up and clapped his hand on my shoulder, thereby driving in one of the pins excruxiatingly. "I'm sorry to tell you, old man," he said, "but some of the trucks have failed to turn up. Do you suppose you could do your stunt just walking?" There wasn't anything to do but to be big about it, so I clapped him on the shoulder and replied, "Well, old man, I guess we can hoof it all right." "That 'e ol' Engineering spirit, old man," he came back. But O! I tell you Genevieve, this walking business was almost the finish of me, for just as we were parading past the P. O. where the crowd was crowded the most, and the Pathé News man was cranking away at his kodak, what should occur but that the pins should loosen to my black skirt. I had a brief but brilliant vission of myself clothed in nothing more than B. V. D.'s from the waiste down, which you'll admit to be quite out of character in an Oak Tree waitress. So I quick shoved my tray into the man's hands who was impersonating Perines and grabbed myself around the waiste, just in the knick of time. But I tell you, Genevieve, it was a "helluva" exciting moment for me.

Well, if I write any more I'd have to put on extra postage, so

Good Bye,

Your,

HAROLD

P. S.—Don't let that Dudley make you think he's the whole shooting match just because he's got those Toridore pants. I must write a theme now on "love" by "Swinburne." H.

The Second Letter:

(From a Sophomore to his grandparents.)

Dear Grandfather and Grandmother:

I realize that I am very slow in thanking you for those nice lavender suspenders you sent me at Christmas-time; but I have been so busy with my college work—calculus, physics, and the rest—that there hasn't been any chance for letter-writing to anybody except the folks at home.

You'll be interested to hear that our Saint Pat's celebration was held late this year, on April 13, in order to avoid, if possible, the cold weather which used to mar the parade on March 17. There was Open House in the morning, with visitors in great numbers. Examples of our work were on display in all the departments: maps, etc., shown by the Civils, design problems and freehand work by the Architects; and the machinery was in full tilt over in the Mechanical and Electrical Engineering Buildings, and the Experimental Laboratory. Guides were provided to show people about, and to keep the ladies away from flying belts and buzzing buzz-saws; and souvenirs were given out—little anvils over in the foundry department, and such things. It must have been of great interest to the visitors to see how things were done, and to see the brawny engineers in their greasey overalls demonstrating this and that.

The parade was as much of a success as last year, when I rode in the baby carriage, although the crowd hedged in the parade so closely that the onlookers didn't get half a chance to read the humorous signs and to appreciate the significance of the various floats. The Arabs were, of course, much in evidence. For advertising genius they certainly win the prize. They never fail to hand themselves bouquets if anybody's looking. But I guess their "Blue God" is going to be some show, though—exotic, and all that, with the usual ravishing music and stage design.

The Seniors were knighted over in the Experimental Building soon after lunch-time. Prof. Ryan acted as the dear old saint, dubbing his knights as they kissed the Blarney stone. That stone, by the way, is the subject of several legends, one of which is that a few years back the Miners got hold of it just before Saint Pat's Day, and hid it, as they thought, most cleverly. But the Civils got out their high boots and other instruments, and swiftly triangulated in pursuit. And lo! the sacred boulder was discovered in no time down in a man-hole at the intersection of Nicollet and Seventh Street. Traffic was suspended while the Mechanicals hoisted it up; and it appeared back at college just in time for the knighting ceremony of that year. So our Seniors are now knights in the Order of St. Patrick—a girl among them, too, Eunice Nielson, who is graduating in Architecture.

Then there was the Green Tea, and the Ball in the evening to which I did not go. I thought it might be well to get in a little study that evening to further me in my career.

Father rather liked those suspenders you sent, so I'm letting him use them just now. Thank you again for your thoughtfulness in remembering me.

Your grandson,

CHARLES.

The Third Letter:

(From a Junior to his kid brother.)

Dear Melville:

I suppose the ice is out of the river by now, so that shack you built on the island is rather out of reach. But then, the water will be warm enough in a couple of months so you can wade over. It's pretty shallow there, isn't it?

The Saint Pat's celebration that I was telling you about has transpired now, and it certainly was a great day. You should have seen the parade, Mel—it was a beaner for sure. The fellows that dressed up like girls were the funniest as usual—the plaid and striped stockings always appear with great success, and the bobbed-hair wigs, too, of course. Some of the serious floats were good, too—the Chemists doing all sorts of wierd things, for instance. The Pathé News man was there, so you'll probably see the whole business in the movies some time soon.

The big "Green Tea" was pulled off in the afternoon, with tea-tables in all parts of the Main Engineering Building, and big samovars steaming invitingly. The faculty wives were pouring and the Freshmen were running up and downstairs with loads of cups and saucers, cookies, cakes, tea, and such things, looking rather happy, but also rather worn. I remember very well when I was a Frosh doing the same stunt. My legs just simply wouldn't operate next day as a result of all that stair-climbing. What seems odd is that the work end of this Tea is done in a measley little kitchen up on the third floor, full of signs saying "Etching materials: do not disturb." But the dish-washing goes on just the same, with the towels as wet as your bathing-suit on a hot July day at the lake. But it's all fun after all, as you'll find when you get down here and have it to do yourself.

You should see the wonderful designs and pictures they have up in the Architectural Department—some real stuff there, for sure; and all foxed up in water-color, with shadows cast, too. They work late enough at night to accomplish things, though. Any hour of the night you happen to go past there's a blaze of electricity from their drafting-rooms.

Muriel and I had tea up in their Studio—Muriel is the girl that you heard me telling Dave Gordon about that day when I didn't know you were in the library, Christmas-time. There are all sorts of casts and vases up there, and big oil-paintings that look very valuable. Some of the casts would have made Aunt Sophy think it was not a very proper party, I fear; but of course they're all from the antique, and anything that is antique must be all right.

Then there was an orchestra groaning away down in the Auditorium, with a big crowd congregated at the doors so we could hardly shove in. The room was all decorated in Irish green, and looked much more festive than it used to when I took my physics quizzes there.

Muriel is an awfully good dancer. Have you learned to dance yet Mel? It's a social necessity.

(Continued on page 30)

HOW TO SUCCEED IN BUSINESS

Famous Steel-Maker Gives Advice to Men About to Set Out for Themselves

By Charles M. Schwab

AS TIME goes on, I find it more difficult to speak of retiring from my forty-three years of business life. In fact, instead of retiring, I find myself drawn more and more into concerns, each of which involves new responsibilities. But the greater the responsibilities, the less I find of the element of personal supervision and the less I enjoy my new work. The thing that has given me the most pleasure and that I am the most proud of is that I keep finding friends, and friends,—and yet more friends on every hand.

You want me to tell you how you can succeed in life. I know that it is very difficult to convince the great majority of people that men who are in active pursuits of life have any other object in view than the making of money. That is a great mistake. The real leaders of industry and the real men in life, and the real successes in life, are not always the men who have lots of money or a great fortune.

My idea of the successful life is the man who has successfully accomplished the objects for which he set out, to do something that is worthy of a real American man. Money is often a matter of chance or good fortune, and is not the mark of a successful life. It is not the thing that brings a throb of pleasure or a thrill into my life. And I would not pose as a successful man if that was to be the measure. But when I look about me and see the multitude of friends that I have after forty years of business association with men, when I see the great lines of smoking stacks and blazing furnaces that have come into being because of my interests and activity in life, and when I see a work that I set out to do successfully accomplished and meeting the approval of my fellowmen, then a real thrill comes into my heart and I feel that I have done something worth while. The money, you do not think about as long as you have enough to pay your bills and keep your business going. The captains of industry do not keep on working for the sake of making money, but for the love of completing a job successfully. Men who typify the ideal business man in my mind are Mr. Carnegie, the elder Mr. Rockefeller, Mr. Baker, the younger Mr. Rockefeller, and Judge Gary.

One of the dearest friends that I ever had in life, Andrew Carnegie, used to say to me when I went to him with my balance sheet and showed him how many hundred thousand dollars we had made that month or year, "That's interesting, but show me your cost sheet." That is the mark of successful manufacturing, how economically and how well you do a thing, not how much money you make in the doing of it. So, his mark—and he was a wise man—his mark of successful industry is my mark of a successful life. Set out with some definite purpose in life and accomplish that purpose. There is little that the human mind can conceive that is not possible of accomplishment. The thing to do is to make up your mind what you are going to drive for, and let nothing stand in the way of its ultimate accomplishment.

Be Honorable

Now, in my long experience in business life and association with men, there are some fundamental things that must not be overlooked. If I were asked to say the most important things that lead to a successful life I should say that, first of all, was integrity—unimpeachable integrity. No man can ever do anything of any great value in life and have the confidence and approval of his fellowmen or be successful in his undertakings with other business men if he doesn't have the reputation of being a man of honor and integrity.

I am going to speak of a young man that I regard as the most successful young man I have ever known. And if I did not regard him as the most successful young man that I know, he would not be the President of the Bethlehem Steel Company. I am going to speak of a young man that I have known since he was a man your age—I refer to Eugene Grace. You may have heard of him. He came from Lehigh University. When I first knew him he was a shoveler of coal with an electric crane. I followed his career on and on and on. And whatever may have been said of Mr. Grace you could always depend upon it absolutely that when Mr. Grace said a thing you would know the absolute facts, good, bad or indifferent. And, today, he stands among the great business men of New York and this country, with the reputation of being a man of absolute integrity and a man in whom everybody can place the greatest possible confidence.

A man must also be a true democrat, and not an aristocrat who condescends to talk with anyone. The educated man must not get the idea that education necessarily makes him superior to any other skilled man who has devoted his life to mastering one business.

When I first entered the business world in 1879, the United States was producing only one million tons of steel a year; now we produce fifty million. Never was the opportunity and the reward so great as it now is in this reconstructed era. The hardest struggle of all is to be something different from what the average man is. I don't believe in "supermen," for the world is full of capable men, but it's the fellow with determination that wins out.

Stay in the United States

Bet on the United States if you must bet at all, for any good enterprise in this country is worth more than six or seven per cent. Put your all into any business which depends for its success on your own brains and determination to win. Be not fearful in borrowing money; I have borrowed more

money than any other man in the United States and on less collateral.

Be sure to go into a business that will keep your interest, for you can't handle workingmen successfully if you only pretend to be interested in them.

If I were able to give you whatever I wanted, I would wish that you might have a rugged constitution, a desire to work, and the great American characteristic of driving onward.

Any man who goes into anything in life and does it better than the average will have a successful life. If he does it worse than the average his life will not be successful. And no business can exist in which success cannot be won on that basis.

Another important thing is loyalty. Be loyal. What measure of success I may have won in life I attribute to the loyalty I had for a dear old friend who was my first steel master, whom you perhaps have never heard of, Captain Bill Jones.

Captain Jones was a great mechanic, just a natural genius at mechanical things. No education at all. He knew nothing of engineering or chemistry or the sciences. Now, I was thrown in, fortunately, with him. I made up my mind that I could be very useful to that man by learning things that he could not learn, and, above all, by being loyal to him and never letting the world know that the things for which he received credit were not his own creation. Did you ever stop to think that a great man in life who has won great acclaim and great reputation is the very man who is willing to share and give the honor to others in the doing of the things that made him great? The man that will selfishly stand alone and proclaim that he is the man who has done these things never is the man who really did them. My own experience is that there is no real effort in life that is not done better under encouragement and approval of your fellowmen. A man goes along then with greater confidence. You must learn to let others share with you in that which you are doing, and honor and credit will be reflected upon you for so doing.

Marshal Foch, the great commander, once said to me: "This great military staff is like an orchestra, and each one fills his place. Each is equally important in the functioning of the whole. If the baton is in my hands it is merely a matter of chance, but we shall see to it that each man in this staff gets recognition for that which is due." You never heard a great man say, "I did this," or "I will do that."

In the management of my great enterprises I have yet to find fault with any man. If a man is such that you must find fault with him to get the best out of him he is not a man to be desired in an organization. Show me the man that will do his best under approval, and I will show you the man that has within him the elements for successful going ahead.

Be Loyal

Now, to come back to loyalty. Be loyal to the people with whom you associate at the start. When this good Captain Jones came to the end of his life's work, do you not suppose it was worth more to me than anything else to have him say: "That is the man that helped me do these things?" Remember always that it will but attract attention and credit to yourself to share it with those who help you. Be loyal when you start life wherever you start. Make your employer feel truthfully that you are sincere with him; that you are going to promote his interests; that you are going to stand for the things he represents; that you are proud of being a member of his staff, and there is nothing that will reap you a richer reward. Loyalty above all!

There are other things in life than mere work. I believe an appreciation of the finer things in life, the learning to know the beauties of literature and art and music, will help any man in his career. A man to carry on a successful business must have imagination. He must see things as in a vision, a dream of the whole thing. You can cultivate this faculty only by an appreciation of the finer things in life. No active business life, whether it is manufacturing or something else, should prevent you from enjoying the beauties of life. These finer things will contribute to your success.

Be friendly. When you have friends you will know there is somebody who will stand by you. You know the old saying that if you have a single enemy you will find him everywhere. It doesn't pay to make enemies. Lead the life that will make you kindly and friendly to everyone about you, and you will be surprised at what a happy life you will live.

I want to tell you a little more about this man Grace, because one often sees the points in a successful life best by analyzing a single individual. I told you of his great faculty of making good, no matter in what position he was placed. This boy went on and on. Above all, he worked hard with the brain that had been trained in the university to think and concentrate upon the subject that he was thinking about until he had reached a satisfactory conclusion. Now, that is the great point, to concentrate and think upon the problem in mind until you have reached a satisfactory conclusion in your own mind, and then finally go ahead. If you have made a mistake, all right. Never find fault with a man because he has made a mistake. It is only a fool that makes the same mistake the second time. I tell a story of my own experience with Mr. Carnegie, as showing what this might mean.

As chief engineer of the works, I had just built a converting mill. I went to him and said to him: "If you will give me the money to build this mill I can save 50 cents a ton." Of course, he provided the money, and the mill was built. He came out to see it. I walked around with him. He saw the look of disappointment in my face and said: "Charlie, there is something wrong here. What is it?" I said: "It is exactly what I told you, and it is better than I told you. We save more than I said. But I don't mind saying that if I had to do the whole thing over again I would do it so and so. I made a mistake in that particular." He said: "Can you change it?" I said: "No." He said: "What does it mean?" I said: "It means tearing it down and doing it over again." He said: "Go ahead and do it. Don't make the same mistake a second time." Do you suppose if he had been a fault-finding man I ever would have told him? Not at all. He brought out the best in me. When that mill was torn down and a second took its place it was as great a success over the first as the first had been over the old one.

Have Confidence

Mr. Carnegie had my confidence, and I had his confidence. He believed in everything I had told him. If I had told him something that was wrong and not admitted my mistake he would never have

(Continued on page 27)

CHORAL SOCIETY TO SING 'ELIJAH'

Mendelssohn's Famous Oratorio Will Be Presented April 16 at the Armory

By Prof. Earle Killeen

NO choral society can exist without at some time singing "Elijah." The University of Minnesota Choral Society elects to begin its career with it, and will be heard for the first time on April 16 with the assistance of the Artone Quartet and the Minneapolis Symphony Orchestra. No finer choice of a choral work is possible, because "Elijah" is a classic which is very much alive today, and a classic every cultured person should know. "Elijah" is a tradition, and we are today making campus tradition through its use; a great chorus at Minnesota which shall be an all-university organization, and which shall sing both modern and classic masterpieces.

Mendelssohn was only twenty-seven years old when he conducted a first performance of his oratorio, "St. Paul." He sought for another libretto immediately. He was not so deeply concerned with what happened to "St. Paul" as he was with writing another oratorio, the fire of composition interested him more than the heat of production. His intimate friend, Carl Klingmann, of London, spent much energy toward a performance of the oratorio in England, and Mendelssohn wrote: "If you would only give all the care and thought you now bestow upon 'St. Paul' to and 'Elijah' or a 'St. Peter' or even an 'Og of Bashan.'"

The composer was not insensible to a business opportunity and enjoyed an enviable reputation while alive, but no sooner had he finished a work than he sought a new subject. He urged Klingmann to give a libretto as a wedding present, and went so far as to outline an "Elijah." His friend did not take to the idea, and though he furnished texts for several short works, he never sent more than an outline of "Elijah." This outline Mendelssohn turned over to another literary friend, Rev. Julius Schubring, of Dessau, and the result was a performance of "Elijah" in England in 1846. For ten years the subject was on his mind. He did not trust his own powers enough to originate a libretto, but he constantly furnished ideas, and preseveringly insisted that his ideas be followed.

Mendelssohn, not his librettist, is responsible for the dramatic form of "Elijah." He was opposed to the style represented by Handel's "Messiah." He declared that all the Old Testament subjects should be dramatic with the possible exception of Moses. "The personages should act and speak as if they were living beings,—for Heaven's sake let them not be a musical picture, but a real world, such as you find in every chapter of the Old Testament," he wrote to his friend Schubring. This treatment, this presentation of Elijah as though he were now among us led to whole scenes rather than a thinly strung series of solos and choruses. Elijah answers Ahab instantly instead of having a chorus intervene, and this connected action of the work led to efforts to dramatize it. Its drama for concert production is intense, but does not lend itself readily to the stage.

Mendelsshon composed to a German text, but as soon as he finished several numbers sent them to London to William Bartholomew to be translated. The fame of the composer had secured him an engagement by the Birmingham Festival Committee for performances in August, 1846. He was to conduct published works of his own, and had suggested that "Elijah" might be ready for a first hearing. Choruses were sent to Bartholomew the middle of May—three months before the performance. Three months is short enough time for a chorus to rehearse such a work, but in this instance the translation was to be made, and plates engraved before the chorus saw the music. Both Mendelssohn and Bartholomew worked at fever heat during these three months, as did the chorus when the music was finished. The composer, whose knowledge of English was considerable, carefully examined every measure with its English text, and very often suggested improvements to Bartholomew. There was no possibility of completing the solos in time for printing, and some of these were brought by the composer when he arrived in England nine days before the performance was scheduled.

The orchestral score had been corrected in Germany, so that when Mendelssohn met the players recruited in London, very little needed to be done. He met the soloists, and went over their parts. He was pleased with all but the soprano soloist who insisted the big aria "Hear Ye, Israel" was not a lady's song. Many sopranos since have not deemed the song one of the most favorable to display their art. There is a persistent F sharp which is not easily sung by all sopranos. Mendelssohn had Jenny Lind's voice in mind when he wrote the work, and urged the Birmingham authorities to engage her, but their efforts were fruitless.

A special train went from London to Birmingham carrying the soloists, the orchestra and part of the chorus, particularly the altos which were male altos, or as Mendelssohn called them "bearded altos." A rehearsal was held Monday, and another Tuesday evening instead of one of the festival performances. Even after the last rehearsal, texts were being corrected and revised until one o'clock in the morning. Mendelssohn was not convinced that the air "O Rest in the Lord" should be sung. He considered it "too sweet" to be included in the program of so dramatic a work. His friends convinced him that he at least should try the song on the public, and so he permitted it to be used.

Wednesday morning early, the audience began to gather at the Birmingham Town Hall. At eleven-thirty when Mendelssohn entered the great auditorium, every nook and corner was crowded. He received an ovation that stirred him deeply. Nearly four hundred performers were at his command, every person there felt they were a part of an important event. The oratorio was enthusiastically received. Eight numbers were encored, among them the song "O Rest in the Lord" which was almost omitted. Mendelssohn records in letters to his brother and friends that no work of his was ever given such an excellent first performance, or

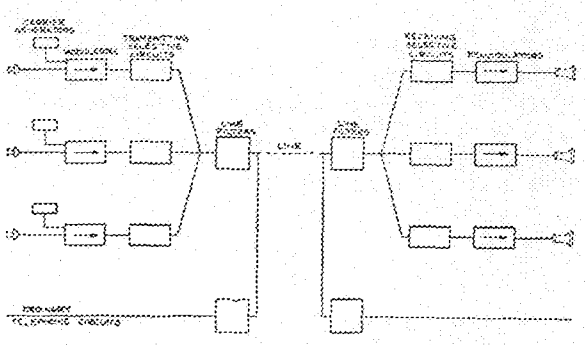
CARRIER WAVE TELEPHONY

Method of Multiplexing Wave Frequency Newest Development In Telegraphy

By Albert W. Morse

PROBABLY the most important development in telephony and telegraphy in recent years is the carrier method of multiplexing. In this system, a single electrical circuit is made to simultaneously transmit several, separate messages in addition to the usual telephone and telegraph facilities of the line.

The multiplex system is made possible through the use of wave filters. They may be likened to sand or gravel screens which allow only a certain grade of material to sift through. Thus, several messages, each on a different wavelength, can be sent over the same wire and separated at the receiving end.

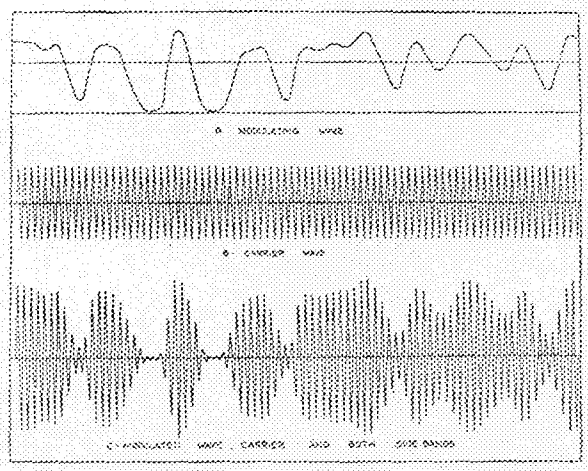


In superimposing different messages upon a circuit, a separate alternating current is used for each one. Since these currents literally "carry" the messages, they are termed carriers. Each message is applied to an individual frequency, and the sending and receiving apparatus at the ends of the circuit are tuned to the same number of cycles per second, so the message is confined to this apparatus alone. The different frequencies vary sufficiently to insure their separation at the receiving end of the circuit.

Certain limits must be observed, however, in selecting the various frequencies. It is primarily necessary to have them at regular intervals in order to facilitate their separation. And then there are dead lines at both the low and high points. Too low a frequency would not be loud enough at the receiving end. Above a certain point, a great number of difficulties are encountered. Energy is lost all along the line. Extremely troublesome interference is set up on the circuits, bothering not only the wires themselves, but also proving a hindrance to neighboring equipment, and necessitating shielding of the circuit all along the route. Wires must be brought into the stations and led out at positions separated by a considerable distance. Networks for filters are greatly complicated. Cross-talk is created, together with generally unbalanced conditions. And there is a limit beyond which the field of radio is entered. Thus far it has been found practicable to employ only the frequencies ranging from 5,000 to 25,000 cycles per second, at intervals of 5,000, namely, 5, 10, 15, 20, and 25 thousand. In actual practice, however, the Northwestern Bell and uses only four frequencies in addition to the regular pair of messages on the circuit.

The actual operation of the system may be outlined as follows: The message as it goes over the wire is a combination of two separate and distinct waves, namely the voice and carrier waves. The former is generated by the transmitter, and an oscillating tube generates the latter. The carrier wave is led into the modulator, where it is modified by the voice wave. The resulting wave then goes into the filter. Here it is given an individual frequency and sent out on the line. The ordinary telephone circuits enter the line at this point, also, and the jumbled mass of messages are transmitted to the receiving end. A line, or "high pass," filter is placed here to allow only the higher frequencies to pass, keeping out the ordinary telephone circuits. The latter branch off in front of the line filter and go through a "low pass" filter, which excludes the high frequencies or carrier waves, and go to the customers. After going through the "high pass" filter, the carrier frequencies, with their actual messages, enter another filter and are segregated and delivered to the proper receiving channels, where a demodulating tube is located.

Demodulation entails the process of reproducing the original, low-frequency, modulating wave by separating it from the carrier wave upon which it has impressed itself. A three-element, vacuum tube is used almost exclusively for this purpose. Its operation is identical to that of the modulating tube, because the application of voltages of two different frequencies produces a complex, current wave in its output circuit. The resolution of the output,



current wave into its components reveals currents identical with the two frequencies which were applied to the input. Therefore, when the received, modulated wave is applied to the demodulating tube, it is possible to determine the frequencies of the two waves actuated by the voice and the carrier generator. The pure voice wave then leaves the

EDITORIALS

"THE TOP O' THE MAWRNIN' TO YEZ"

We note with concern the remarks in the editorial columns of a recent SKI-U-MAH, in which fallacious and pernicious statements were made relative to the honored Patron Saint of our college.

While admitting that Saint Patrick may have been an engineer because of his ability as the inventor of the first worm drive, the editorial advances the theory that he was also a lawyer, and, to add injury to insult, that he was a doctor, too. Various ethereal and mystifying evidence, or rather ingenious invention, is advanced to clothe the whole with an appearance of verisimilitude and exactness.

With this flagrant and startling example of an invasion of our most cherished and beloved of traditions, we feel that it is necessary to present the facts of the matter in the correct light; and remove any harm and injustice done by this publication when they announced to their readers that Saint Pat was other than an engineer of the first water.

No lawyer would have taken it upon himself to drive the snakes out of Ireland, rather he would have attempted to obtain a permanent injunction against them, enjoining them from harming any of the inhabitants, their heirs, their assignees, and their agents.

And furthermore, could any doctor have done what our good Saint did, and in as efficient a manner as he did? No, thrice no! For of a certainty he would have diagnosed the snake ailment as merely "A dangerous case of delirium-tremens—we must operate immediately, sir!"

But, be that as it may, we appreciate the warm feelings they displayed toward the engineers in wishing us "God-speed" in our celebration, and we add our voice to the campus-wide cry, "Come on, Engineers, Let's Go!"

ENGINEERS AND CAMPUS ACTIVITIES

"Oh, yes, I'm one of those roughneck engineers." How often do we engineers explain ourselves in this way to the rest of the University. In these words we are giving expression to the ingrained feeling that the engineers have a little more spirit, more pep, and push than the students of other colleges. We pride ourselves that we engineers do things in a rough and ready fashion that gets results. Our engineering esprit de corps demands that we rather look down on the "academic" and his slightly more "cultured" ways.

Now, this spirit is a wonderful thing. We know its power. We are again proving in the Stadium-auditorium drive what has been so often demonstrated before, that the engineers are the original "go-getters." But there is one unfortunate aspect of this attitude described above. In fighting shy of the so-called "tea-hound" end of the campus we are missing out on the broadening influence of college activities.

Forensics, dramatics, publications and allied activities seem to have come to be centered on the academic campus, merely because the engineers have stood aloof from them. Forensic societies, dramatic clubs, the Daily, the Gopher, the Ski-U-Mah, and a great many other organizations offer just as much in the way of development to the engineer as to any other student. We have shown what we can do in our own college with the Arabs, the Techno-Log, and the Bookstore, but let's come out of our shell and show the "Academics" what we really can do in these activities.

We need engineers to try out for the debating teams, we need engineers as reporters on the Daily, we need engineers writing stories for the Gopher and the Ski-U-Mah, we need engineers playing star roles in student dramatic productions. Let's show them how the engineers do it.

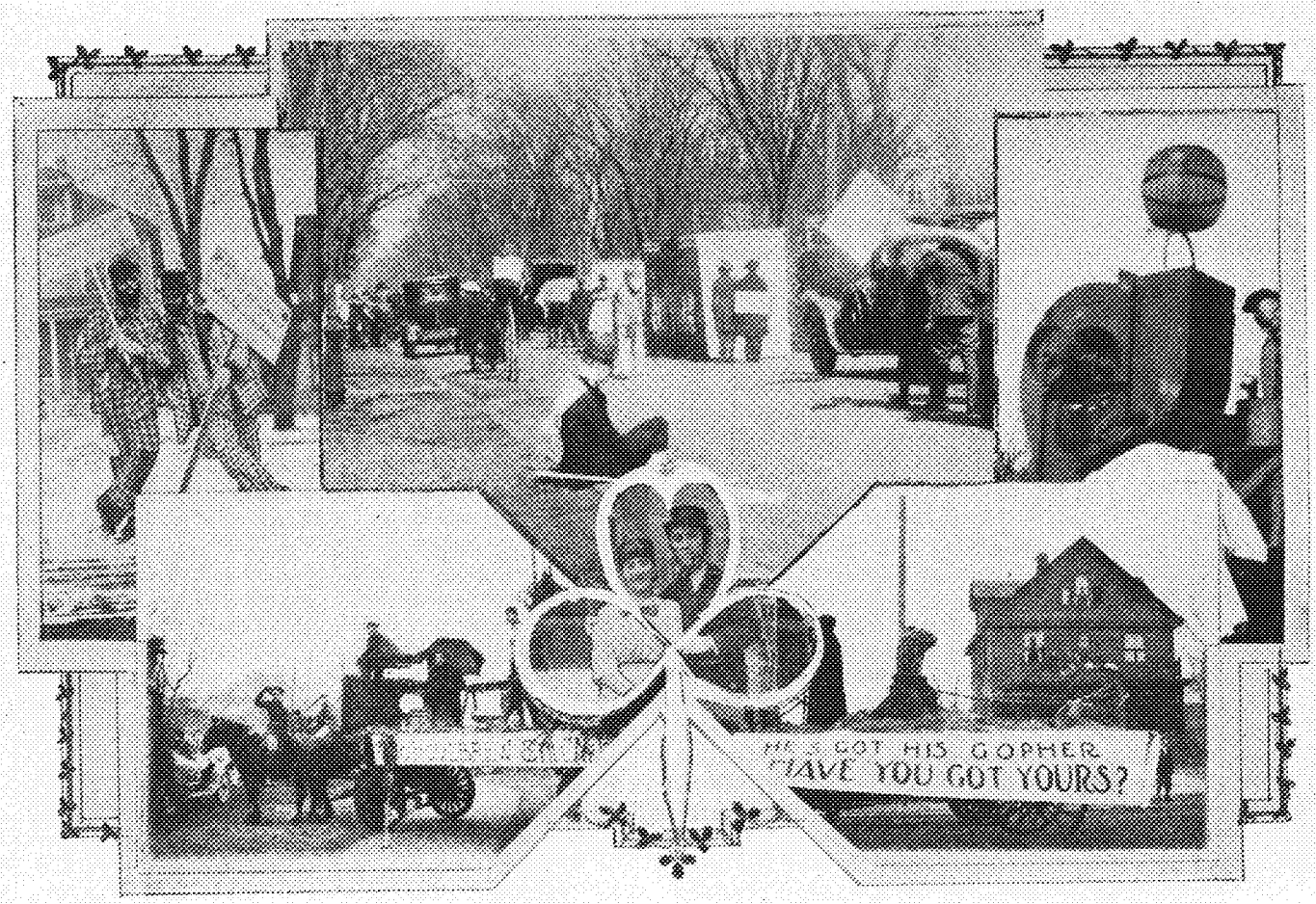
THE ALASKA ROAD COMMISSION

In Alaska, the construction, repair and maintenance of roads, bridges, trails and related works is given by law to the Alaska Road Commission under Colonel James G. Stesse, Major John C. Gotwals as Chief Engineer and Captain Agnew as Secretary-Treasurer. The sum of $8,000,000 has been spent in a period of eighteen years for 6,290 miles of roads and trails, reaching from open-all-the-year south coast ports to all inhabited parts of the Territory. The most important project of the commission is the Valdez-Circle Military Road or Richardson Highway, extending from Valdez, an open-all-the-year south coast port, to Circle, on the Upper Yukon River, some 531 miles. This road is now passable except for about 79 miles. Now that the Government Railroad is completed, an interesting tour may be made in over the Government Railroad and out over the Richardson Highway by automobile, all in twenty-five days from Seattle back to Seattle, without any hardships and at a reasonable cost.—Michigan Technic.

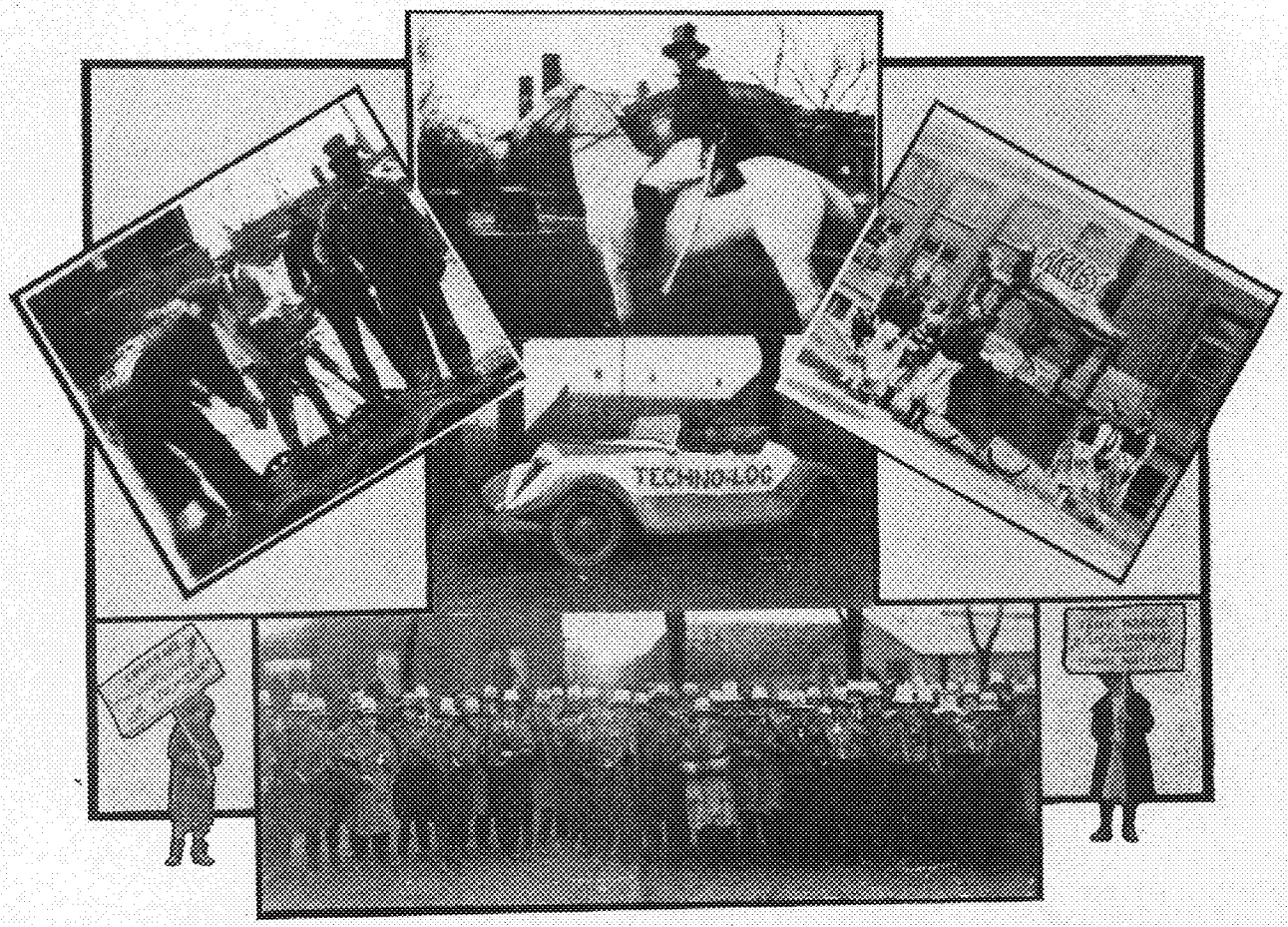
THE CARIBOU SILVER MINE

Considerable interest has been evinced throughout the state of Colorado in the revival of the old Caribou silver mine, upon which operations were suspended in 1893, due to the demonitization of silver by the United States Government. The driving of the Boulder County tunnel has been the most important feature of the entire rehabilitation scheme.

The revival of this mine will contribute greatly to the reanimation of the metal mining industry in Colorado, especially in Boulder County.—Colorado Engineer.

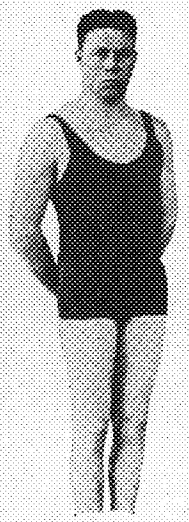


St. Patrick's Day Parade, 1921

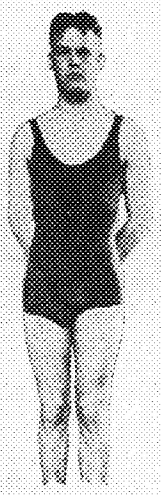


The 1922 Parade

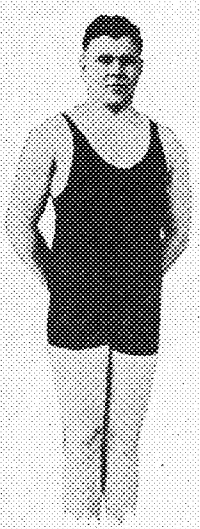
SPORTS



Harold Bird



Hibbert Hill



Horace Nutting

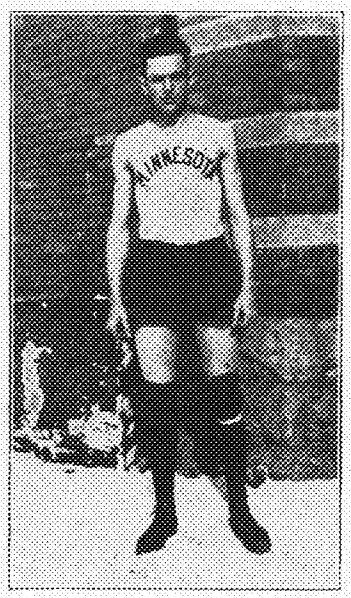
SWIMMING

To be touted all season as the probable winners of the conference championship, and then to lose that coveted place by a scant two points, was the bitter portion of the Gopher swim team. The Purple of Northwestern once more flies from the championship mast, due largely to the work of Breyer, Purple star, who scored 17 of the total 32 tallies which brought home the championship.

A review of the meet leaves one with a feeling of disappointment, since there were so many places that the Gophers' 30 points could have been stretched to a winning margin IF—, however, this is the way it happened.

The relay team took a third to start the evening's grief, slipping badly, since a second was the least expected. Gow, star gopher dashman, came back in the next event, the 40, with an unexpected second. Bird, in his first year of conference competition, took an undeniable first in the dives with some of the prettiest work ever seen in Bartlett Pool. Lanpher swam a pretty race to take second in the 220. In the next event, the 200-yard breaststroke, Minnesota surprised the field by taking three places, first to Faricy, third to Dinmore, and fourth to Clint Merrill. Nutting and Hanft each took a fourth in the plunge and backstroke respectively. Gow and Lanpher finished off with thirds in the 100 and 440.

Breyer of Northwestern set two new records, a conference record in the 40, and a national intercollegiate record in the 440, but the feature of the meet was the breaking of the long standing backstroke record by Hubbard of Michigan.



Grant Bergslund

Intercollegiate championships, held this year at Princeton, were this year open to all colleges of the country. Minnesota was represented by Harry Dinmore, senior miner, who took a third in the breaststroke. The event was won by Czerwonky of Wisconsin.

VARSITY BASEBALL

The call for candidates for the baseball team has brought out about fifty men who have been working regularly in the Armory. Thirty of these men practiced every afternoon during vacation. The work indoors is not very satisfactory on account of the limited space and poor light, but the men have all been working hard to be in the best possible shape when the outdoor work does come. There are ten candidates for the pitchers' jobs and early prospects seem to show plenty of good material. Coach Watrous is up against a big job as there is a great scarcity of veterans. Those who are available are Capt. George Myrum, 3d base; Sampson, left field; and Friedl, pitcher. Infield material is plentiful and as far as can be seen looks pretty fast. The outfield has had no chance to work as yet.

The baseball schedule is as follows:

April 28—Northwestern here.

May 5—Iowa here.

May 12—Wisconsin at Madison.

May 17—Kalamazoo Normal at Kalamazoo.

May 18 and 19—Michigan at Ann Arbor.

May 26—Wisconsin here.

June 2—Northwestern at Evanston.

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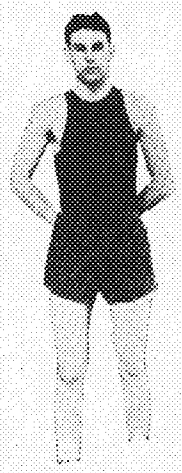
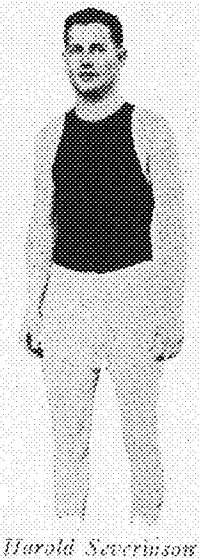
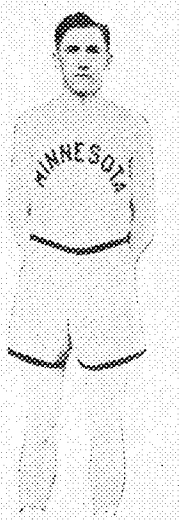


Cyril Pesek



Harold Severinson



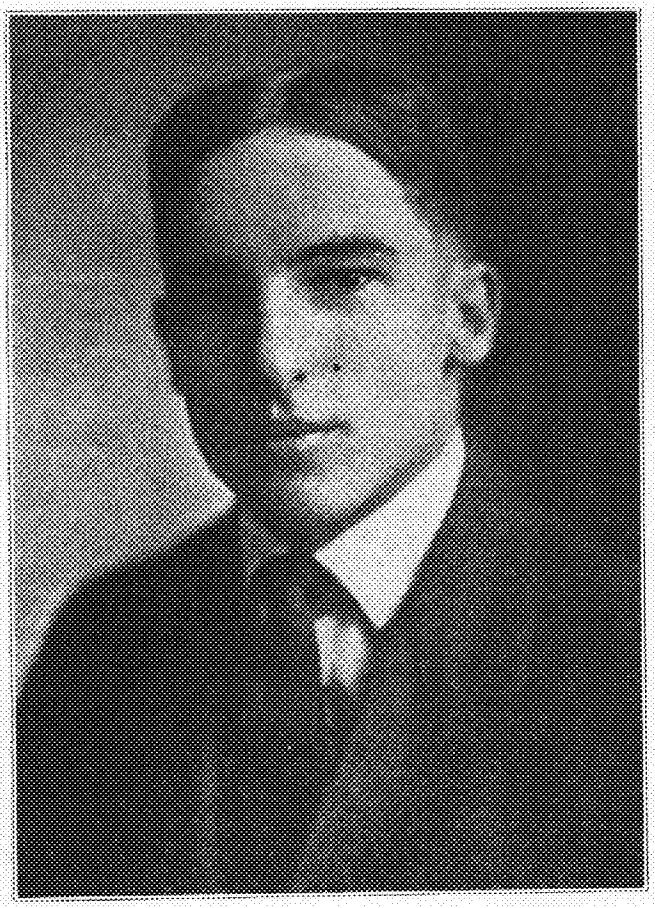
Capt. Arthur

"THE BLUE GOD" IS CLEVER PRODUCTION

By Phil. F. Hartman

ON APRIL 20 and 21 you will see the Arabs in their second musical comedy production at the new Music Auditorium. It will be difficult to recognize classmates with whom you are very familiar in their assumed roles of the dainty damsels of "Upper and Under Mongolia," unconscious as any co-ed ever hoped to be. Most appealing of all are those beauties in the chorus of 113,000,000 ancestors, who range from angel-eyed blonds to black, vampire brunettes, and from Engineers to Tau Bets.

W. Lyle Borst, leader of the chorus, holds a most enviable position, indeed—on stage. But, aside, good sirs, their singing and dancing give promise of diverting and highly interesting entertainment. There are to be sixteen musical numbers, most of them being written in a distinctive exotic meter.



Glanville W. Smith

It is rumored that Theodore Prichard, who takes the leading feminine role of Queen "Gardens-in-the-Rain," has been wearing diminutive shoes in preparation for a portrayal of a true heroine. Other members of the cast have been seen with beauty culture magazines in their possession.

Alden Olds is playing another lead, that of "Prince Pretty-Is" of Umbrellaston.

The sedate and crafty high priest, "Itchy Palm," is played by Clarence Teal, who is well known in campus drama work. Lyle Borst will portray "One Punk Lung"; Robert Montgomery is "Maybe-So"; O. C. Stagberg acts "Flim-Flam"; Eddie Holien is

(Continued on page 28)

FEDERATED AMERICAN ENGINEERING SOCIETIES

Representatives of the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, and American Institute of Electrical Engineers organized an Engineering Council on June 27, 1917. The purpose stated was "to provide for consideration of matters of common concern to engineers, as well as to those of public welfare in which the profession is interested, in order that united action may be possible."

Importance of the work led to consideration of enlarging the scope of activities, and a movement in this direction came June 18, 1918, when the American Society of Civil Engineers passed a resolution which stated that the profession of Engineering is deeply affected by changes in sociological and economic conditions. Various other societies formed committees of investigation; and these developed into a Joint Conference Committee. This committee was to determine in what manner the societies could operate in welfare work affecting the engineer and society.

The Joint Conference next issued an invitation to one hundred and ten engineering and technical societies to appoint representatives for a convention at Washington, June 3 and 4, 1920. Seventy-one societies attended. Here resolutions giving the Federation power to act on questions concerning vital engineering welfare problems were passed, and the executive board has thus far adhered closely to these resolutions.

When the American Engineering Council, the board of directors of the Federated, met in Washington, D. C., on November 18, 1920, 21 organizations were officially represented. At this meeting, Herbert Hoover was elected the first president, and work of perfecting an organization through which Engineers might work effectively on national problems was begun.

Policy

1. No engineer can receive any direct material benefit from the Federated. It is an organization of organizations rendering public service.
2. The Executive Board has never acted upon a measure opposed by an entire delegation from one society.
3. The Federated has readily responded to requests made by society members.
4. The Federated has refused to deal with questions within the scope of any one society.
5. The Federated will not function in regard to work which concerns an individual engineer.
6. The Federated will not interfere with city functions now performed by engineers.
7. The Federated has advocated that engineers be appointed as members of certain national boards.

Finance

For 1923 every society is assessed the same amount—$1.00 per member. Adjustments are made and the total assessment from which the budget is figured is $48,765.93.

Each year a budget is prepared and is adhered to so that expenditures come within its scope.

F. A. E. S. Work

1. It has taken care of its own organization.
2. Waste in industry. Funds were raised and a waste committee assayed the waste in six of the

(Continued on page 28)

COLLEGE NEWS

ARCHITECTS

MARCH DESIGN AWARDS

Thousands and thousands of designs have passed before the jury this month, the night of March 22 being marked by a particular orgy when an accumulation of seven problems was judged all in one hectic seance. The announcement of awards is as follows:

Freshman Design:
An Entrance to a Park
High Awards:
R. A. Cohen
J. T. Grisdale
D. Doon

Sophomore Long:
A Small Library
Mentions:
P. P. Bross
Catherine Howard
Dorothy Brink
E. W. Krafft
E. Molander
P. M. Havens

Sophomore Esquisse-Esquisse:
An Entrance to a Courtyard
Credits:
D. W. Rankin
Aubrey Grisson
Chester L. Carjala
George Freeberg
R. S. Lantz
P. M. Havens
Merdon Busler

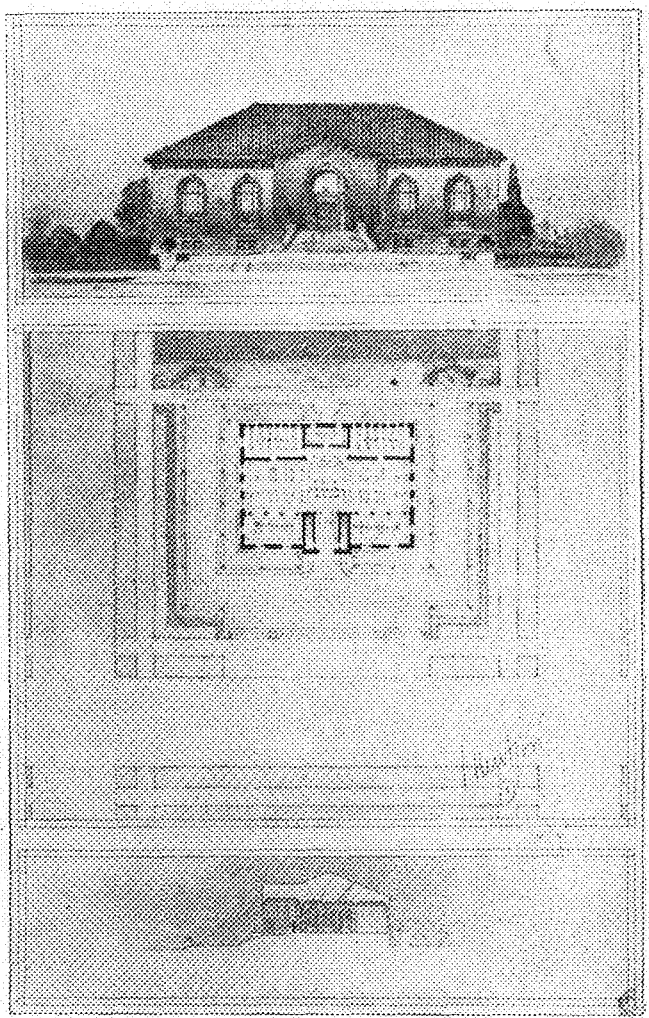
Junior Long:
A City Church
Mentions:
Olaf S. Fjelde
I. Woodner Silverman
H. A. Magoon
Mark L. Nelson
Paul E. Nystrom
Rahel Rosenberg

Junior Short:
A Recreation Pier
Credits:
Anton Johnson
C. R. Barnum
H. A. Magoon
E. F. C. Backstrom
Wallance Bonsall

Junior Esquisse-Esquisse:
An Aquarium and Fish Hatchery
Credits:
Glanville Smith

Interior Decoration, 2nd:
A Ball Room Chandelier
Credits:
Marion Petri
Carl Matthias Wise
Arthur Ruddy
Olive Prescott

Interior Decoration, 3rd:
A Private Theatre
Mentions:
Carl Matthias Wise
Olive Prescott
Marion Petri



"A Library for a Small Town"
Mention ..... P. P. Bross

Senior Long:

A Bank in a Small Community
Mentions:
J. A. Walquist
Theo. S. Sime

Senior Short:

A Summer Residence

Mentions:

E. L. Johnson
Theo. S. Sime
J. A. Walquist
Eunice Nielson

Credit (commended for presentation)

I. Woodner Silverman

Senior Landscape:

A Summer Estate on Lake Johanna

Mention, 1st prize:
Mention, 2nd prize:
Mention:

E. L. Johnson
Theo. S. Sime
Eddie Holien

STILL-LIFE

The Studio has been animated during all the past quarter by the splashing of aquatic water-colorists, the squoosh! of cadmium being goozled from the tube, the dropping of paint pans, and other noises indicative of an epidemic of still-life painting. "The demon Life-in-death is she"—and demoniacal has been the fury with which vermilion and Hooker's green have been transferred from the expensive tubes to the expansive paper.

"These are fast colors," crooms one soft voice, as a rivulet of carmine suddenly descends from a background wash over a brass pot depicted as emerald and midnight blue. Nearby, an earnest youth is painting celery in cobalt and gamboge: no wonder the celery has wilted.

Before her easel stands our painter in oils. She has been taking her leave for three-quarters of an hour now, so she has on both galoshes. Soon her fur coat will be donned, then she will paint a bit more—a Harrison red high light on a green jar, say—and then, eventually, she may depart. But isn't it hard to tear oneself away from one's art, though, don't you think?

Our diplomat from Washington is also on deck. She is in a smock and picture hat, making it difficult to guess whether or not she has come to stay. The question is, how did she get the smock on over the hat? But that leads us far astray into complexties too deep for conjecture.

A fearful blast of whistling announces the arrival of Izzy—or is it Glanville? If it is the latter, Dudley Watsons Krafft paints with greater power and sweep than ever, and casts about for some topic over which they can mutually (and loudly) disagree.

Crash! Bert Eberhart has let her board descend with a thud, just as Bill Woollett dropped three pans and a paint box. It is lucky that one of the pans was filled with water, or the repercussion would have been much greater than it was. A wail from Rosie completes the momentary din—somebody has made French blue speckles all over her nice clean drawing!

Then on swish the paint-brushes, on wrinkle the perplexed brows; and the onions and turnips sit so patiently while their picture is being "took."

Several suggestions for still-life groups have been made by interested spectators. The Techno-Log staff respectfully submits the following:

1. a flat tire
2. a lemon
3. a lemon
4. a dumb-bell

The contrast between the various textures exhibited in the group must appeal strongly to every artistic nature.

And then, why not

1. a book of verses underneath a bough
2. a jug of wine
3. a loaf of bread
4. and thou—?

If that isn't still-life, what is? Or, to continue in the highbrow literary strain—don't read farther if this makes you feel faint—why not compose the group suggested by Carl Sandberg in *The Rake-off and the Get-away:*

"Anvils, pincers, mosquitoes, anguish, raspberries.....?"

And, gentle reader, if you think that anguish does not properly belong in a still-life list, it is evident you've never painted draperies!

THE RESCUE

(Motto: Can't You Take a Joke? She Did)

"Are we our brother's keeper?" asked the Seniors of one another as the time for the completion of a design problem grew nearer and nearer to a close, and one of their number failed to appear for labor on his design. A vote was taken: "We *are*," was the unanimous decision, and away paraded the Seniors on their quest.

The object of the quest was not far to seek. In the Freshman drafting-room he bent over a half-rendered Park Entrance design. He was picking out the high lights, snapping out the shadows, bringing out the plane relations, and washing out the foliage. With her head on one side, her lips pursed, and her eyes "harf-closed," his protégée, his—er—but call her what you will; anyway, *she* was surveying the process, and adding helpless suggestions, timid commands, and brave retractions.

And the Seniors, finding that their Ulysses had untied himself from the mast of duty, and was now basking on the shore, (ah! a classical allusion!) gave competition in a siren-song of their own—*Love's Old Sweet Song* it was, done with not so much regard to harmony as to feeling and pathos of expression.

Ulysses' lip curled with a derisive sneer, for the more enchanting strain still chimed in his ear. But the Seniors, recalling their firm resolve, surrounded him, took him into cussed custody, and bore him out feet-foremost. In a moment he found himself placed with a jar to his rigid and refractory spine on the stool before his own neglected design.

"Just a song at twi-light
Ta de da da da.....
And the flick'ring shadows
La de come and go....."

But Ulysses' lip still curls at this counterfeit enchantment, for the true melody yet whispers itself into his charmed ear.

CHEMISTS

"CHI" AND ELSEWHERE

They're off!

Who?

Ah! That's the question.

Who?

Why, twenty-five of those "stink-evolving, grass-dissolving chemical engineers."

night was yet young when they boarded their train at the Milwaukee depot and departed for "'Chi' and elsewhere" to be gone for ten long days.

The occasion, which at present in the minds of some of the readers is unknown, was the annual inspection trip of large commercial laboratories and industrial plants in and near Chicago. In their wanderings, with Dr. Mann as Lord High Wanderer, which took them to Milwaukee, and Carrollville, Wis., and to Argo, Joliet, and all sections of Chicago, they visited plants which produced many and divers products. They saw how leather, paint, coke, gas, gasoline and oils, and steel were manufactured, lead refined, and chemicals prepared. In fact, little happened without their seeing it, as Dr. Mann and the report to be handed in in the near future insisted upon their observing every detail.

The Pfister-Vogel Leather Co., Newport Chemical Co., Patton Paint Co., Universal Portland Cement Co., Standard Oil Co. refineries, U. S. Lead Refining Co., and Illinois Steel Co. were among the plants visited.

ANTE-POST-MORTEMS

When this is read by the curious and foolish, Friday, April thirteenth, will be history. Engineers' Day—Nineteen Twenty-three—will already have accepted its nook in history, and post-mortems will be the rage. And yet I find it necessary to tell you what the post-mortems will be weeks before the event! Such is the beauty of magazine writing.

Ye who remember St. Pat's Day of 1922, of 1921, of 1920, of 1919, and all the way back into history, all remember the chemists' contributions as vile odors, bombs of terror and general destroyers of peace within and about the parade. Were you not surprised at this year's contribution? Didn't the manufacturing float look innocent at the time? (Never mind discussing the after-effects. Those of you who escaped them need never know; those of you who did not, deserve the protection of secrecy.) And didn't that tomb strike a sad spot in your heart? Oh shades of valerianic acid! Didn't the chemists fool you this year!

And now we reap our reward. Don't we deserve some credit for permitting human beings to enjoy the parade in physical comfort? Don't we deserve some thanks for not producing a sea for the Irish Navy of 1922? And, greatest of all, don't we deserve a little recognition in the day's name?

All Hail the Engineers' Day of 1923—it was a dandy; and All Hail twice for Engineers' and Chemists' Day of 1924—it will be better than ever!

THE NEW BABY

A new element has come into the chemists' world. Although its presence has just recently been verified, the possibility of such an element—in fact, even certain properties both chemical and physical of the element—was prophesied years ago. In looking at the latest revised periodic table we see that there are still many unfilled positions. A few chemists have gone so far as to state their ideas as to the properties both chemical and physical and the atomic weights of elements which will eventually be discovered and be put in their place. Through a thorough knowledge of the arrangement of the elements in the periodic system and the properties of the elements it has been possible to do this.

Until lately, hafnium was one of these elements. But now it has been separated from other elements and its properties are being carefully studied. The reward for its discovery is due to Dr. G. Hevesy of Copenhagen. Dr. Hevesy has found that a great many samples of zirconium, taken the world over contain from 5 to 10 per cent of hafnium. It is extremely difficult to separate it from zirconium and is therefore found in from 1 to 5 per cent in all commercial preparations of pure zirconium. The atomic number is 72 and it has an atomic weight somewhere between that of lutecium, which has 175, and tantalum, which has 181.

The commercial importance and value of this element is yet an unknown factor and scientists are looking forward with great interest to the time when more detailed information as to its special properties is given out. Although the exact amount of hafnium in the earth's crust is not known, one may estimate it from the amount of zirconium. According to Mr. Clark's estimate, the zirconium content of the earth's crust is 0.018 per cent; therefore, roughly, the hafnium content is 0.001 per cent. This value may not be even approximately correct; in fact, it is quite possible that it may exist in even larger quantities.

Who will discover and give to the world the use for which hafnium was intended? Who will be the scientist to discover and separate the next new element and give to the world an invaluable substance? Who? Well, darn'd if I know. It might be some budding chemist here at Minnesota. Who knows?

CIVILS

THE CIVILS GRADUATE

President Coffman delivered the commencement address Thursday, March 23, 1923, at a banquet which was held in the Minnesota Union. Many degrees were conferred, including fourteen of the variety, B.S. in Civil Engineering.

The next morning, fourteen proud Civils, armed with the long sought diplomas, set about in search of jobs. A few had positions lined up some time ago, among these being Lloyd Peck, who is with the Elgin, Joliet, and Eastern Railroad at Joliet, Ill., and Rolf Bergford, who is Assistant Engineer of Tests with the Minnesota State Highway Commission. George A. Meskal is also with the highway commission.

There is a great deal of construction work going on at present, and jobs seem to be plentiful, most of the men being placed successfully after a day or two.

The following men have registered as indicated for their graduate work in the "College of Bread and Butter":

Harry Abrahamson—Illinois Highway Commission.

Leo Buhr, George Guessmer, Henry Manger, and James Darrell—with the Northern States Power Co. development on the St. Croix River.

Edward C. Dindorf—Truscon Steel Co. in Minneapolis.

Albert Johnson—Truscon Steel Co., Youngstown, Ohio.

Morris Lazerowitz and Everett Thompson—Minneapolis Steel and Machinery Co.

Elmer A. Nelson—C. A. P. Turner.

John Swanson—with a consulting engineer at Escanaba, Mich.

Arne Aasland is in the sales department of a Minneapolis printing company.

ELECTRICALS

THE ELECTRICAL PARTY

Everyone is interested and attracted by the mysterious. The Arabs journey to far away China in quest of it, but we have it near at hand, the mysterious electric fluid which has puzzled and baffled investigators from ancient times. The things which used to be considered wonderful about the stuff are no longer so, but new properties and possibilities have been discovered, so that we believe that electricity—the swiftest messenger, and the most powerful servant of man—playing the fool for a day, may also furnish unrivaled entertainment.

The Electricals will be at home for their friends, for the last time in their present domicle, the old building, at the Fifth Biennial Electrical Party, which will be held early in May.

The old building will be transformed over night. Every available machine and square foot of floor space will be given over to the exposition of various physical principles in bizarre, amusing, and yet instructive ways. Alternating current will be on display so that one may actually see it alternate. There will be lightning, miniature, and not so miniature. Something new is promised in radio, and there will be other features which cannot be mentioned here.

A dance in the Engineering Auditorium, of no ordinary kind, and refreshments will follow the "shocking" exhibits in the Electrical Building.

OUR WASHINGTON DELEGATE RETURNS

Prof. C. M. Jansky, Jr., returned just in time for classes from Washington, D. C., where he was called to attend the recent radio conference. The meeting was initiated by Secretary of Commerce Hoover, to consider a redistribution of wavelengths made necessary by the rapid increase in the number of broadcasting stations and the consequent interference, and by the failure of congress to pass the White bill which was to have solved the difficulty. Following the successful conclusion of the meeting, Mr. Jansky visited the Bureau of Standards and the Naval Radio Laboratories, and the Signal Corps Headquarters, and on his way back he went through the Westinghouse plant and saw the manufacture of a new vacuum tube which is about to be put on the market.

A. I. E. E.

The last A. I. E. E.meeting of the winter quarter was held in the Engineering Auditorium on Thursday evening, March 1st. Roy Olson spoke of the plans for the next meeting which is to be held during April. A banquet is being planned and the meeting is to be solely a student affair. Definite announcements will be made later and all Electricals should try to attend because it will be one of the big meetings of the year.

The speaker of the evening, Mr. E. R. Martin of the Electrical Department, talked on railroad electrification. A film, sent out by the Westinghouse Company, was shown in connection with his talk. Locomotives were shown in the various stages of manufacture and in actual operation. There is no doubt that every one present was impressed by the advantages of the electric locomotive with regard to smoke, dust, soot, cinders and noise as compared with the steam locomotive.

Some of the outstanding differences in the two [illegible] locomotive type [illegible] tive effort cannot be as large, for the same weight, as that of the electric. Electric motors have a constant torque, while the torque of a reciprocating steam engine varies from zero to a maximum value during each stroke of the piston. At the steam engine's maximum torque the drivers are liable to begin to slip, thus reducing the available tractive effort materially.

It is impossible for steam trains to run on schedule in cold weather because of the large increase in boiler and engine losses and, as cold weather is usually accompanied by slippery tracks, the steam locomotive is at a decided disadvantage. On the other hand, cold weather increases the efficiency of electric transmission lines and motors and an electric locomotive may be overloaded with little danger of overheating.

The electric locomotive can make much better time when descending long grades, with less wear on equipment, and at the same time is able to return some of the energy to the line. The steam train is limited by the rate at which the brake shoes and wheels can radiate the heat generated. In some cases the train must stop to allow the shoes to cool, and when the air-brake system leaks—as it always does—the system must be recharged with air frequently. It may be interesting to note that when the power demand on the C. M. & St. P. electrified lines is not large and trains are descending grades, there may be more energy generated than can be used up. Water rheostats, placed in rivers, are a convenient means of dissipating the surplus energy.

Electrified lines, in spite of their high initial cost, have shown favorable returns when compared with steam roads and in the near future we may expect to have all large city terminals electrified as they now are in New York City.

While we were busy getting ready for finals, and during the past vacation, the Minnesota Section of the A. I. E. E. held two most interesting meetings, as the considerable number of students who attended will testify. At the first of these, held March 16, 1923, at the Elks Club, Minneapolis, Mr. C. E. Skinner, Assistant Director of Engineering of the Westinghouse Electric and Manufacturing Co. spoke on "National and International Standardization." It is interesting to note that one of the difficulties here is that the European tendency in rating is to be much more liberal than the American.

At the following meeting, Mr. H. A. Affel of the Department of Development and Research of the American Telephone and Telegraph Co., of New York City, told something of how his company is able to successfully transmit five telephone messages or channels, or ten telegraph channels over a single pair of line wires, by means of the carrier current principle. The subject announced was "Carrier Current Telephony and Telegraphy." The apparatus and methods used are quite similar to those of radio telephony. The talk was illustrated by slides showing the equipment, schematically and pictorially, and so was of quite general interest. The Bell Company has found this system uneconomical for lines shorter than two hundred miles, and it is at present impractical over cable circuits, but its general success is attested for by the fact that there are now about 30,000 channel miles telephone and 100,000 channel

The Second Annual Banquet of the Electrical Department will be held Wednesday, April 18, 1923, at the Minneapolis Y. M. C. A. This will be altogether a student affair, and should be bigger and better than the first. The student branch of the A. I. E. E. is in charge of the arrangements. The most cordial relations have always existed between the Student Branch and the Minnesota Section, and we have often accepted their invitations and enjoyed their hospitality at meetings and social functions. Now we hope that the Minnesota Section will join with us in this banquet which we hope they will enjoy.

9XI ON THE AIR AGAIN

The new transmitter at the University Radio station in the Electrical building, is practically completed. Already it has been tested, using A. C. on the plates, while waiting for the installations of the motor-generator set which will furnish D. C. the permanent arrangement. The rated input will be 200 watts, and with the new antenna which has already been put up, Minnesota should make more of a stir in the ether than ever before. Broadcasting will not be attempted, for there are too many such stations now, and some of these are better able to give the necessary reports and news.

The station will be used entirely for laboratory and general experimental work and for training in station operation, and is in charge of H. C. Forbes who has superintended its construction.

The plans for the new Electrical building are gradually being worked out by the Electrical faculty together with the state architect. The building when completed will be the very best in every way. The department has made a study of the electrical buildings and laboratories both here and abroad and are embodying the desirable features of all of them.

Mr. Williams of the Western Electric Co., Mr. Smith of the Illinois Bell Telephone Co., Mr. Mills of the American Telephone and Telegraph Co., and Mr. Kingsly of the Northwestern Bell Telephone Co., were here for several days last month interviewing Seniors in the electrical and mechanical departments as prospective men for their organizations. Many of the Seniors have received offers from these companies and several of the men may be accepting the propositions. Mr. Seeger of the Cutler Hammer Co., Milwaukee, and Mr. Imes of the Century Motor Co., St. Louis, have also been here interviewing men. These latter companies are smaller and want only a few men from each school.

SPRING STYLES

Engineering toggery will, with the coming of spring, soon be on display. The civils will soon don their corduroy trousers and boots for outdoor surveying work. The spirit of the level and transit is then felt throughout the college; the upper classman looking upon it as a memory while the Freshman feels it as an inspiration.

Now that several of the places well known to the followers of Aristotle have been closed by authorities, university functions are receiving fuller attendances. Civils were very much in evidence at the Sophomore Frolic held March 17, in the Union

MECHANICALS

The Neptune Meter Company of New York gave the Experimental Engineering Department a tank and accessories for work in Hydraulics. The tank has an unusually quick opening valve; it has scales which read in cubic feet or gallons of water, and a special calibrating device.

A wooden tank has been constructed for more experimenting in Hydraulics. Earl H. Lund and S. R. Cray, graduate civils, are using this tank with a new type of wier. Some interesting results are expected from their work.

The Experimental Department recently purchased a new refrigeration machine for research and experimental work. It is an electrically driven 5½x5½ ammonia compressor, rated at 7½ tons capacity, built by the Vilter Company, and designed to chill to 20 degrees below zero. The department has put in a cold room to use with the machine 12x12x9, and lined with eight inches of insulating material.

Floyd C. Olmstead has experimented with heat transmission at low temperatures, using actual wall sections of different insulating materials.

The machine and cold room will be used to study the effects of low temperatures on gas engine operation. The plans are to experiment with crank case dilution, carburation, ignition and starting devices of the gasoline engine.

The department expects some interesting data on the effects of freezing and thawing on concrete highway construction. There will also be a series of experiments of freezing and thawing setting concrete, and determining the low temperature limit of concrete in building construction.

The Seniors and Post-Seniors have organized an employment bureau which will endeavor to locate the members of this year's graduating class in positions for which they are best fitted.

A committee of the following members has been appointed to carry on the work:

Arthur Gilstad, Chairman
Floyd C. Olmstead
Grant C. Bergsland
Shelden S. Hibbard
Edward V. Brossard
Roland Cross

The committee is sending letters to the employers of mechanical engineers stating the branches of engineering in which the members have specialized.

The Senior Mechanicals will have a large choice of experiments for laboratory and research work during the spring quarter. They have about twenty-five experiments from which to choose one for the quarter's work. The schedule is planned so that the men work alone or in small groups.

Some of the students will experiment with various fuels for gas engines of the semi-Diesel type and the Foos engine. Work will be done on lubricating oils and the effects of temperature on lubrication.

Heat losses through the water jacket and by exhaust gases, and the maximum temperature allowable in the gas engine will be computed. There will also be a test of the new refrigeration plant. Other Seniors will experiment on pumps, engines and steam boiler equipment.

Some of the Seniors have been doing practical work with Minneapolis companies while attending school. Arrangements have been made with others to give more men experience in certain lines. The Minneapolis Street Railway Company, Northern States Power Company, Northern Fire Apparatus Company, Flaxlinum Insulation Company, and the Puffer-Hubbard Company are some who have agreed to help the department.

In several cases manufacturers have donated either fellowships or specific funds to the Engineering College for research and investigation along various lines. As a general rule it is desirable on the part of the companies to confine the research to their particular field. Some of the companies who have given such research funds in the past are: fellowships by the Flaxlinum Insulating Company, Northern Fire Apparatus Company, United States Radiator Company, American Society of Heating and Ventilating Engineers. The Flaxlinum Insulating Company has recently given a fund of $1,000.00 for research and publication concerning insulating materials. It is hoped that in the future the number of these special arrangements may be increased as the work is of mutual benefit to the industries, to the college, and to the students.

The graduate mechanicals are working on practical research problems for their theses. Olaf T. Rood is experimenting on the viscosity of oils; A. C. Luce is determining heat tables of ethyl chloride; Floyd C. Olmstead is working to determine the value and comparative cost of coal and oil for domestic heating. Arthur W. Kumm is making a cost analysis of central heating plants for cities having power plants and using exhaust steam for heating. They have not done enough work so far to give the results of their research and experimenting.

A. S. M. E.

The student branch of the A. S. M. E. held a special meeting in Room 104, Mechanical Engineering Building. Professor Rarig of the Public Speaking Department gave the fundamental rules of speech and gesture, and pointed out the mistakes speakers commonly make. His talk was very interesting and much appreciated by the members.

Dr. Prosser, of Dunwoody Institute, was scheduled to speak at the regular meeting, on March 17, but was unable to come. Professor Flather consented to talk in his stead. His topic was "The New Spirit in Industry."

Plans for the remainder of the year were discussed. Mr. Stillwagen, of the Ford Motor Company, has promised to talk on the proposed Ford plant during the spring quarter. There will be election of officers at the April meeting, and the annual picnic will be held in June.

Calvin W. Rice, national secretary for the American Society of Mechanical Engineers, gave an illustrated lecture to the St. Paul and Minneapolis sections of the society, in the auditorium of the Main Engineering Building, on Friday, March 30th. More than two hundred engineers in the two cities were present.

Mr. Rice recently returned from a tour of South America where he attended the Engineering Congress held at Rio de Janeiro. At this congress three important resolutions were adopted: first, to effect a permanent organization; second, to establish a standardization bureau in every Pan-American country; third, to call a meeting of the American nations to develop the dream of an intercontinental railroad.

In South America, Mr. Rice says, the engineer has the seat of honor; he is a leader in the political and social life of the country. His theme for the evening was that, "precise knowledge and trained hands will result in new social and scientific concepts which can contribute much to the advancement of mankind and that it is the duty of every professional man to render the best possible service to his particular community."

According to Mr. Rice the chief difference between the North American and South American is that the latter's interests are wider and more comprehensive than the North American. He is a citizen of the world and a lover of the beautiful. Mr. Rice compared several newspapers of South America with those of the United States. Those of the southern continent averaged about eight pages, two of which were devoted entirely to world news, while our home papers devote almost the same space to scandal and sensational crime news. In contrasting the two, he pointed out the effect that such news has on the growing generation. Motion pictures and colored slides were used to illustrate his talk and show the various places visited on his tour.

"The Twin City Ford Plant at the High Dam" was the subject discussed by Col. L. H. Britton of the St. Paul Association at the latest meeting of the Society of Automotive Engineers held April 4, 1923, at the Manufacturers' Club, Minneapolis. This is a subject about which we are all eager to learn something definite, and those students who accepted the invitation to attend which was extended to us, were well repaid.

Mr. C. M. Stroud of the Oakland Service also spoke on the relation of the car owner to the service man.

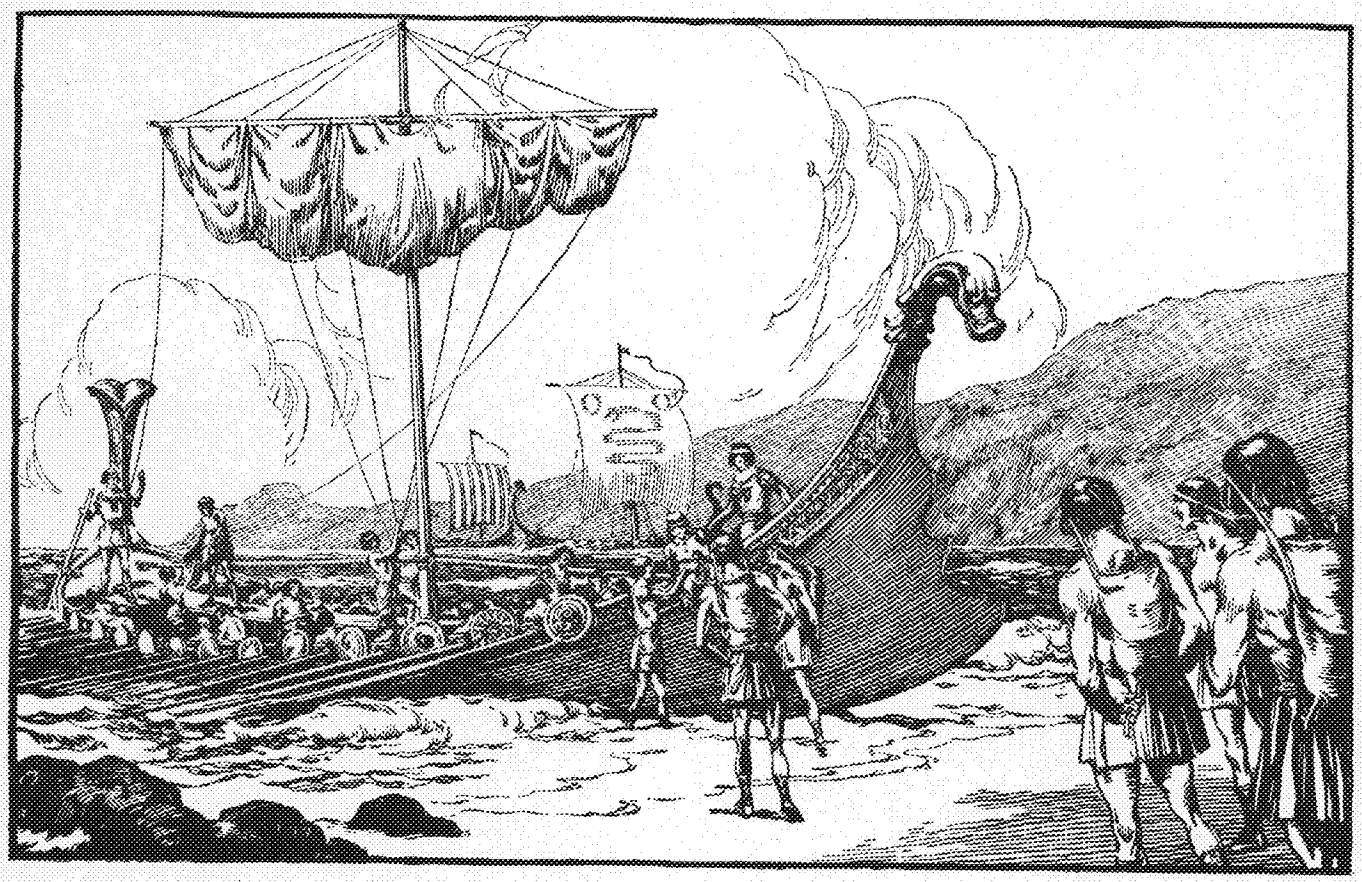
Experimental Mechanical Engineering

Professor Frank B. Rowley, head of the department of experimental engineering, is superintending the formation of plans and the installation of a new refrigeration plant to be used in the research work on heat transmission through building materials. A cold room will be installed, in which a temperature of 20 degrees below zero (Fahrenheit) may be reached.

Professors Shoop and Tuve have been doing extensive work on the revision of the "Mechanical Laboratory Manual" which was published for the first time last year. The manual is being used this year by classes in experimental engineering.

Professor B. J. Robertson is engaged in research work on alcohol burning in gas engines.

The University of Nebraska celebrated in honor of St. Pat for a whole week from April 23 to the 28th. The first day opened with a big Engineers' Convocation, the next day all the department store windows had their displays and exhibition, and the third day featured the big parade and open house. The field day was a great attraction with the big dance in the evening and the week closed with a banquet.



Silver for Hiram of Tyre

Hiram of Tyre was the metal king of the world in the tenth century, B. C. From Spain, his fleet brought back every third year the entire production of what is now the Rio Tinto Mine.

Three tons of silver a year was all that 40,000 workmen could produce in Hiram's time. In a recent year, at the same mine, 9,000 men, with the aid of explosives, mined 2½ million tons of ore. From this ore, almost 30,000 tons of copper alone was obtained.

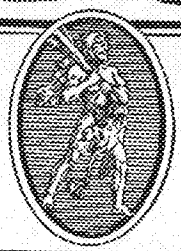
But the cost of time and labor are so much higher now than when King Hiram worked the Rio Tinto that even dynamite, as great a labor saver as it is, must be scientifically selected and used.

On work for which it is suited Hercules Special No. 1 is more economical than the usual grades of dynamite. It contains about one-third more cartridges per case than 40% dynamite which it often replaces, cartridge for cartridge; at a saving of about twenty-five percent in blasting costs. It contains nothing but the highest grade of standard materials and by wide use on many kinds of work has proved its dependability.

To help you in using explosives most effectively, we have prepared a series of practical booklets. If you have not yet received them, write to our Advertising Department, 939 King Street, Wilmington, Del., for free copies of "Eliminating Waste in Blasting", "Scientific Quarry Blasting", and "Hercules Products".

HERCULES

POWDER COMPANY



Allentown, Pa.
Birmingham, Ala.
Buffalo, N. Y.
Chattanooga, Tenn.
Chicago, Ill.
Denver, Colo.
Duluth, Minn.
Hazleton, Pa.
Huntington, W. Va.
Joplin, Mo.
Los Angeles, Calif.
Louisville, Ky.
New York City
Norristown, Pa.
Pittsburg, Kan.
Pittsburgh, Pa.
Pottsville, Pa.
St. Louis, Mo.
Salt Lake City, Utah
San Francisco, Calif.
Wilkesbarre, Pa.
Wilmington, Del.

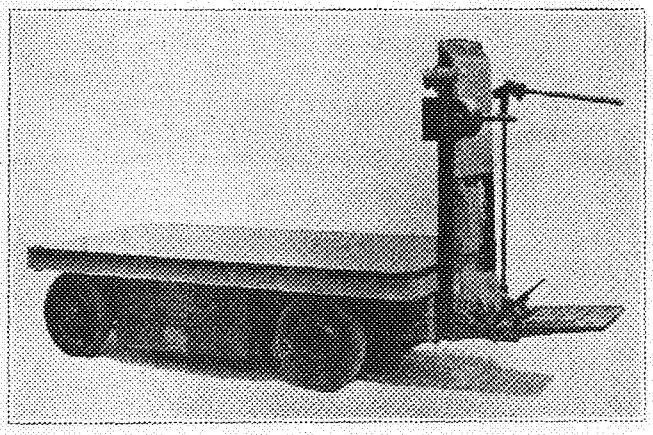
MINES SCHOOL GETS NEW TRUCK

Electric Industrial Type Truck Embodies Latest Design Features

By Albert W. Morse

THIS is an age of labor-saving development, and the electrical industrial truck which will soon be put into service in the new mines experimental building is an excellent example of the progress already accomplished along this line.

It will be of the electric self-loading-and-unloading type, with an end-dump hopper mounted upon its platform, enabling it to quickly haul and dump approximately one cubic yard of ore, coal, ashes, sand, or similar loads. Although its rated capacity is 4,000 pounds, it has considerable over-load ability, giving it a decided advantage over hand trucking, and further eliminating the attendant noise, inefficiency, and congestion of the workmen.



The New School of Mines Truck

Mechanical features of the truck are especially interesting. Of course one thing is important in a place filled with machinery, as the mines building will probably be, and that is the ability to move freely. A four-wheel steer takes care of this requirement, giving the truck an exceedingly short turning radius. The motor is of low voltage, and is built by the truck manufacturer himself for heavy duty. It is a 24-volt, 60-ampere model, capable of making 1,700 revolutions per minute. In the usual type of battery-operated truck, there is danger of heating the motor when the machine stalls either in a hole or on an incline, the full effect of the battery going into the motor, necessitating the use of fuses. This truck, however, is equipped with a power unit capable of taking the full capacity of the battery, and there are no fuses.

The chassis construction follows closely that employed in automobile practice. Hot-riveted, structural steel is used in the frame, which is supported on the axles by heavy, coil springs. Steel castings and drop forgings are used throughout. All wiring is brought through steel conduit into a terminal box located immediately in front of the operator, where it is easily accessible. The controller is of a continuous, torque type, free from arcing, permitting operation without danger of fire. An all-metal perfect alignment of contact segments, which in turn are of heavy copper, firmly secured by screws, and easily renewed. The fingers are wider than usually necessary, providing a large contact area necessary for large amounts of current consumed with overloads and on severe grades. A safety switch makes starting of the truck impossible without being in the position of the driver, guarding against the possibility of accidents. This switch is operated by sliding fingers actuated by the foot pedal, and it is arranged to cut off the current when the brake is applied. The safety switch and brake are synchronized to permit coasting without movement of the controller drum. Brakes are of the heavy, external, contracting type.

Power is derived from an Exide, 12-cell, 17-plate, "MVXY," Ironclad storage battery placed in a demountable steel case, permitting a quick change of batteries. The usual specifications call for only a 15-plate cell battery, but two more are provided for emergencies when extra power is required. The lead plate feature of the battery provides a flash current when conditions threaten a stalling. There are three speeds forward and three reverse, with maximums of 6 miles per hour empty and 5 miles per hour loaded. Driving is accomplished through a set of single reduction, steel worm and bronze gears operating in an oil bath in oil tight, compact housing. Differential gearing is of the standard automobile, four-pinion type, fitted to the driving gears and drive shaft. Cast wheels revolve on a double set of annular roller bearings, equipped with fabric tires. Axles and housing are of standard automobile design, having steering knuckles, with hardened and ground knuckle pins and renewable bushings. The drive shafts are nickel steel.

Until recently almost unknown, the industrial truck is now considered a necessary adjunct to modernly equipped manufacturing plants, railway and steamship terminals, warehouses, in fact anywhere goods are transported distances within the premises of a plant. They have been found to do the work quicker and better than was done by other methods, doing away with more expensive and complicated conveyor systems, and eliminating the danger of fire from friction.

The University of California celebrated St. Pat's Day with the usual parade depicting different phases of engineering work and progress, and a special chemical warfare feature of an attack of a heavily defended machine gun nest by a war strength platoon of infantry. This was followed by a barbecue, open house, pow-wow and in the evening the Engineers' Dance.

John E. Morrison, C. E. in '22, is now with the N. S. P. Co., in the special construction department at Riverside Power Station, on the Mississippi

Engineering Levels Mountains

The Pack Train has become a relic of the past, along with the Prairie Schooner. Modern methods of transportation have leveled mountains, brought San Francisco nearer to New York, and widened the markets of all our great industries.

And the engineering brains and energy, that have developed transportation to the prominence it holds in the business of the world today, are no longer employed in improving means of overland travel alone. Street Railways, Elevator Systems, Interurban Lines and Improved Shipping Lines—these are some of the accomplishments of engineering in the development of better transportation.

Neither have the builders of such systems been concerned only in the actual hauling of people and materials. A study of the methods of handling passengers and freight at the large terminals has developed the Terminal Engineer, who has greatly improved existing methods, and has developed entirely new ones, as well.

Engineering, as it is applied to transportation, has had to concern itself with many kinds of materials and many ways of handling them under all manner of circumstances. For instance the problems surrounding the handling of iron ore, in bulk, are vastly different from those encountered in moving any one of the finished products manufactured from iron ore, that must also be transported in large quantities. But Engineering constantly meets each situation with improved transportation facilities.

Industry, as a whole, and the nations and the people of the world owe much to the engineers, associated with such large manufacturing industries as Westinghouse. They have not only brought about vast improvements, but they have done so at a constantly decreasing cost to those who derive the greatest benefit from them.

ALUMNI

H. J. Budan, C. E. '22, and Leo Buhr, B. S. in C. E. '23, are working as instrument men on the St. Croix River, investigating for the Byllesby Corporation on the stretch from the mouth of the Kettle River to Danbury, Wisconsin. Manger, B. S. in C. E., is field computer and draftsman on the same work. The party is now in camp on the St. Croix River near the mouth of Bear Creek. The men may be addressed either at Hinckley, Minnesota, or Granstburg, Wisconsin.

R. C. Blair, formerly with the C. E. class of '23, who recently completed a set of maps for the city of W——, Minnesota, is now engaged with the Byllesby Corporation as assistant on surveys on the St. Croix River. Address Grantsburg, Wisconsin.

Immediately after graduation in March, James Darrell and George C. Guesmer, B. S. in C. E. '23, were engaged to do engineering work on the St. Croix River for the Byllesby Corporation. Mr. Darrell is working as topographer and Mr. Guesmer as field computer and draftsman.

Wm. S. Kelley, B. S. in C. E. '22, who has been working with the plant department at the State Fair has joined the above surveying party and is engaged at present in establishing a level line from Nevers Dam up stream for a stretch of about twenty miles.

These men can be addressed at Wolf Creek, Wisconsin.

James Merdenhoff, B. S. in C. E. '21, who has been engaged in surveying the interior of Old Mexico for the past year and a half, has returned to Minnesota and is now engaged with the Byllesby Corporation on the investigation of the St. Croix River. An interesting letter concerning his work in Mexico was recently published in the Techno-Log. His present address is Grantsburg, Wisconsin.

E. G. Seeman, B. S. in C. E. '20, is now with the Cowin Steel Company, of Minneapolis.

Henry Leude, B. S. in C. E., has recently joined the staff of the Minneapolis Park Board.

Leslie Halliday, B. S. in C. E. '21, is employed as engineer with the City Planning Commission of Minneapolis.

Harold Cleary, '22, is with the electrical department of the Stone & Webster Co., operating at La Crosse, Wisconsin.

John West, C. E. '15, from the time of graduation until 1918, worked as assistant in the physical education department. From 1918 up to the present time he has been County Highway Engineer and is now Resident Engineer for the state. He is with the Lincoln Co. and may be addressed at Ivanhoe, Minn.

Arthur Hoistkotte, C. E. '22, is in Sugar Pine, California, working on sawmill construction with F. W. Hoistkotte Co.

Victor Wood, C. E. '22, is with the State Highway Department on the north shore of Lake Superior. His address is Two Harbors, Minn.

Bill Kelly, '22, is now in the employ of the state at the University Farm. He is conducting experiments which concern the durability of drainage tiles.

Bill Woolett, apropos of the supply of "Oh Henrys" in the candy store: Say, Iz, we'd better get six more "Oh's," don't you think?

Peevish voice from the rear of the drafting-room: You should say "ounces," Bill, not "oz."

HOW TO SUCCEED IN BUSINESS

(Continued from page 8)

helped me to progress, and his works and his great establishment would never have progressed as they did.

Now, in my own establishment you will be interested to know something about how we do things. You boys will all probably have to start to work upon a salary. But the quicker you get out of working for a salary the better for all concerned. In our works at Bethlehem and San Francisco, and all over the United States, I adopted this system: I pay the managers of our works practically no salary. I make them partners in the business, only I don't let them share in the efforts of any other man. For example, if a man is manager of a blast furnace department he makes profit out of the successful conduct of his department, but I don't allow him to share in the prosperity of some other able man in some other department of the establishment. I give him a percentage of what he saves or makes in the department immediately under his own control and management. For example, if it takes a dollar a ton to make pig iron, and it takes him a dollar a ton to make pig iron, I say to him:

"Well, you are no better than the average manager over the country. Therefore you are entitled to only the usual wages. But if you can make pig iron at 90 cents a ton you are entitled to share with me in a large part of the profits. And if you make it for 40 cents or 50 cents a ton you share to a very large degree."

Therefore, I don't care how much a man earns. The more he earns the better I like him. And I pay in what I call bonuses to the various superintendents and managers of the different establishments more money for their successful management than I pay the stockholders of the concern in dividends. And it will surprise you to know the great sums of money that some of these men make. I would be afraid to tell you for fear of discouraging you in your start in life. But I don't mind saying that forty, fifty, sixty, a hundred thousand dollars a year for these men is not infrequent. And in the case of men like Mr. Grace, well, many, many times that.

If you have any influence in the world to get you a start in life, don't use it. The worst thing that can happen to a man is to start life with influence. He has got to do twice as well as the fellow that starts upon his own merits, because, after all, it depends on the general opinion of all those around you as to how competent and successful you are, and when everybody says that you do well because of the influence back of you, then you have got to do twice as well as otherwise. If you are going into any manufacturing establishment, don't go there by reason of any influence you may have. Start upon your own merits, and start in some lowly position, no matter what it is. Be a laborer, if you will. I don't know but that is the best way to start.

This great war has taught us many things. The one thing it has taught us above everything else is that the true life is the life of modern democracy and simplicity, that it is not one of show or of extravagance, that we are men because we are men and because we have the true instincts of men, and we are not men because we are rich or because we occupy a high social position or because we have influence.

Go at your work. You may not find your [illegible]

first year. You may start at work that you think will not be agreeable to you. Do not hesitate to change. If you find that it is not according to your tastes and ultimate ambitions, then change and go into something that is more pleasant. No man can be successful at work if he doesn't find the work he has to do pleasant. No man can ever do a thing well that he is not interested in. When you start in life, if you find you are wrongly placed don't hesitate to change, but don't change because troubles come up and difficulties arise. You must meet and overcome and conquer them. And in meeting and overcoming and conquering them you will make yourself stronger for the future.

Then go on and select your work. Let us suppose you become a craneman. Suppose you become a clerk in a lawyer's office. Give the best that is in you. Let nothing stand in the way of your going on.

Opportunities must come naturally, and the only way that they can come naturally is to give your whole heart, give your whole soul, give your every thought, give your every act to the accomplishment of what you are going to undertake. If you will but make up your mind and determination to go through with what you undertake, you will do that which will bring you more genuine pleasure, satisfaction, and comfort in life than anything else you will ever do.

"THE BLUE GOD"

(Continued from page 14)

cast as "Wim-Wam"; Ted Waldor plays "Sugar Beet" very sweetly; and Carl Wise performs "Lima Bean."

The "Blue God" is fast, light and rollicking. Glanville Smith, author of the presentation, admits it has a plot. Songs, written and composed by Al Holmer and Sam J. Sutherland, are as rollicking as the play. The orchestra is under the direction of Frank Christlieb. Earle Killeen of the Department of Music is directing the play.

The "Blue God" will be first played on Friday night, the twentieth. On Saturday afternoon there will be a matinee and a final presentation in the evening.

FEDERATED ENGINEERING SOCIETIES

(Continued from page 14)

largest American industries. The report drawn up has become a text-book for producers.

3. Committees have made studies of working shifts and industrial ideals, and have gone into the heart of management even in so far as it affects the engineering student.

4. F. A. E. S. has investigated problems of water power.

5. Little is known of flood control, which every year takes much of American money, and many lives. The Federated is endeavoring to secure passage of a bill establishing a national hydraulic laboratory.

6. An unbiased and unpartisan statement of Muscle Shoals is being drawn up. This will certainly be of much value.

The Federated American Engineering Society has co-operated in some 28 projects with other societies, and unit organization has shown its importance in these.

CARRIER WAVE TELEPHONY

(Continued from page 10)

demodulator, is amplified, and is delivered to the subscriber.

Although telephone practice permits only four channels of the multiplex system in addition to the two regular messages, telegraphy differs in its possibilities. Since November 16, 1922, there has been a multiplex telegraph system in operation by the Northwestern Bell Telephone Co., between Minneapolis and Chicago. It consists of ten channels of telegraph in addition to the two regular ones over one pair of wires, and each channel can be operated each way. These ten require five tubes each, making a total of fifty tubes. Three are used for receiving, with two for amplifying and one for detecting. And two are required at the sending end, with one for amplifying and one for oscillating.

INDIAN SURVEYING SIGNALS

Early in the nineteenth century the British Government initiated an extensive survey of India. Heaps of stones, poles, or other opaque signals were first employed, the angles being measured by day only, but eventually it was found that the atmosphere was often more favorable for observing by night than by day, and that distant points were raised well into view by refraction by night which might be invisible or only seen with difficulty by day. Lamps were then used, consisting of a simple cup, 6 inches in diameter, filled with cotton seeds steeped in oil and resin, burning under an inverted earthen jar with an opening on the side towards the observer. Subsequently this lamp gave way to the Argand lamp with a parabolic reflector. The opaque day signals were discarded for heliotropes reflecting the sun's rays to the observer.

The introduction of luminous signals not only rendered the night as well as the day available for observation, but changed the character of the observations, enabling the work to be done during the dry and healthy season of the year when the atmosphere is generally hazy and dust-laden instead of being restricted, as formerly, to the rainy, unhealthy season when distant objects are best seen. A higher degree of accuracy was also secured, for the luminous signals were invariably displayed through diaphragms of the openings and, looking like stars, they could be observed with greater precision, while opaque signals might be dim or seen eccentrically when light falls on one side.

Heliotropers were employed to flash instructions from the observers.

The annual Engineers' Ball at the University of Colorado had very unique programs consisting of a miniature transit with the plumb-bob attached to the cord. The order of the dance turned inside the vertical circle while across the telescope was printed, Engineers' Ball '23.

Two new members have recently been added to the exclusive Minnesota circle at Pittsburgh. Arny Enger, '22, is working in the service test department, and Bob Donahoe, '21, is in the transformer department.

'TERRIBLY INTIMATE PORTRAITS.'

(Continued from page 6)

and you'd better learn before you get into High School. And long pants this summer, too, I hope. This business of waiting until after your Freshman year before changing is all the bunk.

Well, I'll write you again some time maybe, Mel, when something else happens.

So long,

THOMAS.

The Fourth Letter:

(From a Senior to a friend doing post-graduate work in an eastern university.)

Dear Bill:

Saint Pat's Day has rolled around again, this time my last. Thus, I'm with you now in the Guard, as one of the "brave, l'yal and faithful b'ys." The old Blarney stone was out, and we did the usual kissing as we were dubbed. I could but recollect three years ago—I was a Sophomore, you a Junior then—when Louis Collins and Mr. Norton were enrolled in the guard. Mr. Norton had to fold his tall self all up, don't you remember, to get his mouth down within kissing range, while Louis just bowed a bit to accomplish the same results. Well—we're knights now, ready to ride forth and subdue the hydra-headed problems of this cold world.

Being in the parade myself I, of course, had no opportunity to stand and watch it sweep by; but I did have a good look at most of the separate items over where the various floats were assembling beforehand. Pretty clever most of them were, too. I didn't see George Bestor in his usual glad rags with much leg in evidence, but he must have been there somewhere, to be sure.

The usual mob scenes prevailed at the Green Tea; it seems to become more of an event every year. It deserves to, too, I think—a good convivial, hearty sort of an affair, without too much of the glad hand to give it the appearance of organized charity.

And the ball in the evening. It was in the Armory, but an Armory both changed and glorified. They'd rigged up a false ceiling of gay-colored paper, and amplifiers carried the music to the most remote corners. It may not be very beautiful, but there have been some mighty pleasant events in my college career connected with that place—the Kreisler concert, and Onegin this year (if you get a chance to hear her out there Bill, don't miss it; she's vundervoll) and basketball, of course, and some good speeches now and then when I did get around to Convocation; and Demon Drill, even, which after all wasn't such a nightmare of a bore as we so fondly imagined. Don't you remember when the sergeant gave us that lecture on the uses of "aheezie-tape" and saluting from a velHICle?

But here came my last Saint Pat's Ball. Well, it was a good one, anyways. I'm so glad that Saint Pat has stuck with us down to the termination of my college days at least—it looked as though he might die out entirely this year, and be supplanted by a mere imposter of an "Engineers' Day," robbed of all the kindly grace that an established tradition built on a picturesque foundation of Irish foolery possesses. The change of date doesn't appear to me as necessitating any change in the tradition, does it to you Bill? No, of course not. I'd hate to come back as an alumnus and find that the dear old saint had been canned from school. Certainly there's nothing that will so estrange the alumni from the college so much as a change in the college traditions with every change in the college administration.

Well—enough of this blather. The Blarney stone must have taken effect already. I've got to get to bed now, or I'll be moony-eyed all day tomorrow. You might write to me sometime again, don't you think?

Farewell,

G.

WHAT'S DOING AND WHERE AT THE ENGINEERS' OPEN HOUSE

All Engineering buildings will be thrown open to the public all day. Instructors will be in their buildings to meet visitors and alumni. The alumni register and lounging room will be located on the main floor of the Main Engineering Building. Student guides will be provided from 10 to 12:30 A. M. to assist visitors. The following displays will take place from 10 to 12:30 A. M. in each department.

Civil Engineering Department

Prize designs and maps.....Main Engineering
Surveying equipment.....Main Engineering
Sample tests on all testing machines.....
.....Experimental Engineering
Highway department display.....
.....Experimental Engineering
Sample paper weights given away by highway department.

Mechanical Engineering Department

Mold making, foundry shop.....
.....Mechanical Engineering
Sample anvils given away.
Forge shop demonstration by students.....
.....Mechanical Engineering
Sample cold chisels given away.
Machine shop demonstration by students.....
.....Mechanical Engineering
Sample gears and vanity cases given away.
All testing and demonstration machines running
Automotive parts display
Coast artillery display
All research and thesis work on display
Hydraulic feature displays.....
.....Experimental Engineering

Electrical Engineering Department

Radio concert.....Experimental Engineering
All equipment on display.
Power plant open for inspection.....
.....Electrical Engineering

Architectural Department

All prize winning designs on display.....
.....Main Engineering

Chemists

Feature display.....Experimental Engineering

LATEST SONG HITS.

"I'm Through Shedding Hair Over You."—By Ed. Finaud.

"When The Leaves Come Tumbling Down."—By Adam and Eve.

"Altho' She's on the Stage, She's Not a Coarse Girl."—From 'Sodium' by Carbonate.

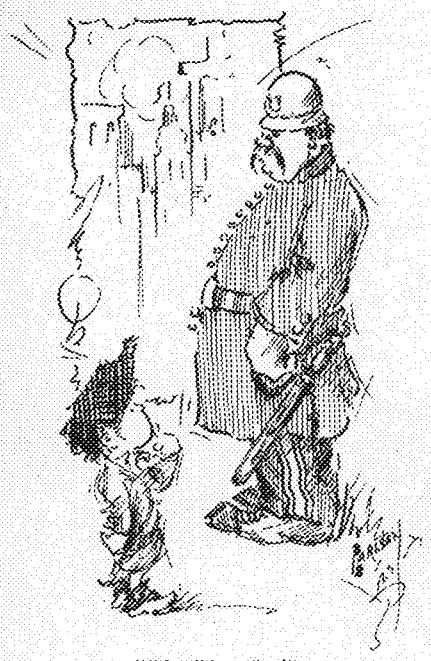
A. Corn says, "The best way to remedy a corn is to soak it in a pawn shop, then shove your foot thru a window and the pain is gone."

Lady, to Grocer—"What have you in the shape of bananas?"

Grocer—"Cucumbers."

"The drinks are on me," said the goof, as the wheels of a brewery truck came to a halt on his neck.

Speaking of ——— "and one day it got so hot that it popped the corn in the field; a team of mules saw it, and, thinking it was snow, froze to death."



"The Blue God"

"To arms," cried the Queen, as the Indians rolled their war-whoops up the street. Whereupon the King laughed, because he had two.

They say a cat has nine lives, but a frog croaks every night.

—Record.

Ruth—"What did Wilbur do when Agnes wouldn't kiss him out on the lake last night?"

Florence—"He paddled her back."

Ruth—"The rough thing."

—Charlotte Observer.

Teacher to little Swede pupil: "What is your name?"

"Yonnie Olson," was the reply.

"How old are you Jonnie?"

"I don't know," he replied.

"Where were you born?"

"I wasn't born, I have a step-mother."

—Exchange.

THE FABLE OF THE TOILER FROM THE TALL GRASS THAT TOOK NOTES.

By Flying Fox.

(With more apologies to Geo. Ade.)

A Team of Tillers of the Soil in a Rural Community were the Proud Parents of an Offspring named Joshua. At an early Age he gave every Indication of being good for Nothing so the Proud Parents decided that he should go to College.

So when he was ripe they shipped him to the Smoky City. Our Hero arrived wearing a stingy little Hat and a Mail Order Suit that fit him like he was poured into it. His Pants ended abruptly four Inches below his Knees leaving a Neutral Zone of about six Inches between his Trousers and his Shoes, giving the Impression that his Pants were mad at his shoes.

He started across the Campus and met a fair Coed. She smiled at him! (It was all she could do to keep from laughing out loud.) He was paralyzed for an Instant but recovered and started to follow her. She went into a Ham and Egg Establishment. It was rush Hour and the Place was full of Cash Customers. Fair and some not so fair Coeds were scattered about in great profusion, each one consuming the hot Groceries and occasionally dipping her Bill into a Saucer of Tea. Our Hero had never seen so many Skirts assembled at one time, not even at the Sociable in the First M. E. Church back in Podunk. He longed to romp and play and eat Eskimo Pies with these bobbed Haired Babies that wore Open-Work Stockings (90 per cent open, 10 per cent Work).

The only Culture he had was Agriculture but he was not such a Lame Brain as he appeared to be, not quite. He decided to take a few Notes. Accordingly he tuned in and listened in on the Line of Gab that the Frails were broadcasting. He gathered that any Goof that could trip the Light Fantastic was the Elephant's Bloomers—Big Stuff. When it came to shocking Oats or Plowing Corn our Hero had all the Neighbor Lads back in Podunk Hog-tied and sewed up in a Sack but as a dancer he was the Cat's Corset. He danced like a Cow with a Crutch, it seemed his Feet weren't Mates.

About this time a pale Youth with a Saxophone Haircut breezed in, his Bell Bottom Trousers clanking in the Breeze. The Janes immediately closed in on him. "Aha, comma, I have it," said our Hero, making mental Note no. 2. "I cannot be a Sailor unless I have a Sailor Suit."

The Pale Youth was an Athlete of some kind, he could throw the Javelin 165 Feet and could throw the Bull much farther than that. "I will have to go in for Athletics," thought our Hero, making mental Note no. 3.

Accordingly, next Day, he started on his Schedule. He went down to Maurice L. Rossmans, Walk a Flight and Pay As You Enter, and picked out a $25, Cash Money, Suit with 2 pr. Pants, bellbottomed. Equipped with this raiment, he began going to the Track every Night (except Monday) and learned to Vernon Castle. His Feet gave him a little Trouble at first, but after two months he had all the rest of the Slickers looking like a Herd of spavined Horses.

The Rations of 2 doz. Eggs and a Side of Bacon that he was accustomed to consume for Breakfast back on the old Homestead had given him considerable Brawn, so he decided to go out for Football.

About the time he made the Team he was pledged to a Fraternity. He was now sitting pretty.

When he approached the P. O. he was surrounded by a bevy of at least a dozen Coeds,—taking Subscriptions for the Daily.

Moral: All is not Cheese that Glitters.

HIGH PRICED.

Fair One: I see here where a man married a woman for her money. You wouldn't marry me for money, would you?

Square One: No, dearest, I wouldn't marry you for all the money in the world.

Johnny: "Papa, did you ever see an artificial whale?"

Papa: "There is no such thing, my son."

Johnny: "Then where does artificial whalebone come from?"

—Georgia Technique.

Academic Co-ed: "The Russians are great dancers, aren't they?"

Bored Engr.: "Unhuh, s'pose so."

Miss S. L. A.: "Yes,' one hears so much of those Russian steppes."

Coed: Why didn't you find out who he was when the Prof. called the roll?

Another Coed: I did try to, but he answered to four different names.

SHOP LIGHTING.

In an address delivered before the members of the Western Pennsylvania Division of the National Safety Council, Pittsburg, Pa., March, 1918, by C. W. Price, the importance of good lighting in industrial establishments was discussed, and the disadvantages of poor lighting were clearly shown by some figures mentioned by Mr. Price.

A large insurance company analyzed 91,000 accident reports, for the purpose of discovering the causes of these mishaps. It was found that 16% was directly traceable to inadequate lighting and in 13.8% the same cause was a contributory factor. The British Government in a report of the investigation of causes of accidents determined a close parallel to the findings of the insurance company above quoted. The British investigators found that by comparing the four winter months with the four summer months, there were 39.5% more men injured by stumbling and falling in winter than in summer.

Mr. John Calder, a pioneer in safety work, made an investigation of accident statistics covering 80,000 industrial plants. His analysis covered 700 accidental deaths, and of these 45% more occurred during the four winter months than during the four summer months.

Mr. C. L. Eschleman, in a paper published in the proceedings of the American Institute of Electrical Engineers several years ago, reported the result of an investigation of a large number of plants in which efficient lighting had been installed. He found that in such plants as steel mills, where the work is of a coarse nature, efficient lighting increased the total output 2%; in plants, such as textile mills and shoe factories, the output was increased 10%.

In an investigation of the causes of eye fatigue, made by the Industrial Commission of Wisconsin, it was found that in a large percentage of industries, such as shoe, clothing and textile factories, the lack of proper lighting (both natural and artificial) resulted in eye fatigue and loss of efficiency. At one knitting mill, where a girl was doing close work under improper lighting conditions, her efficiency dropped 50% every day during the hours from 2:30 to 5:30 P. M.

The above mentioned incidents indicate how important a factor lighting is in the operation of the industrial plant. It has been well said, "Light is a tool, which increases the efficiency of every tool in the plant." Glare or too much light is as harmful as not enough lighting, and in no case should the eyes of the workers be exposed to direct rays, either of sun or electric light.

Windows and reflectors should always be kept clean; that is, cleaning them at least once a week, for where dust and dirt are allowed to collect, efficiency of the light is decreased as much as 25%.

Good lighting, in addition to its other marked advantages, is a strong incentive towards keeping working places clean, for it clearly exposes any place where dirt or other material has been allowed to collect. White walls and clean windows glazed with Factrolite Glass will eliminate the sun glare and increase the illumination 25 to 50 feet from the window from 58% to 73% as compared with plain glass.

Lighting is of primary importance to every employer and fully warrants a careful investigation of the subject, for there is no substitute for good lighting, and if it is not supplied the efficiency of the entire working force must suffer a serious reduction.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

SPORTS

(Continued from page 13)

June 4—Iowa at Iowa City.

June 14 and 15—Ohio State here.

Additional games will be scheduled with the Minnesota colleges to be played before the conference schedule starts.

VARSITY TRACK

With the coming of warm weather, track men are beginning to prepare for the outdoor track meets. The indoor season has been completed and Minnesota did well considering the serious drawbacks which came up. Prospects for a successful outdoor season are very good although the loss of men like Hawker, Anderson, Hoverstad and Schweitzer of last year's team, will be seriously felt. Veterans left include Willson, Campbell, Hirt, Schjoll, Gross, Hultkrans, Martineau, Neubeiser, Madsen, Oster, Ulrich and Winter, and these men, together with some promising new material, should make a strong showing for Minnesota during the coming meets.

The list of events and the men from whom the Minnesota representatives will be chosen is as follows:

Dashes—Capt. Willson, Gruenhagen, Hultkraus.

440-yard Run—Howard, Partridge, Hultkrans.

Half-mile—Winter, Hirt, Partridge.

1 and 2-Mile—McLaughlin, Ulrich, Simonds, L. Brown, Jacobson.

Hurdles—Martineau, Towler, Cranston, Fuhrman, French.

Pole Vault—Mel Kelly, Osander, Schjoll.

High Jump—Campbell, Cranston, Towler.

Broad Jump—Faricy, Campbell, Smith.

Shot Put—Gross, Schjoll, Neubeiser.

Discus—Gross, Schjoll, Neubeiser.

Javelin—Gross, Schjoll, Neubeiser.

Hammer—Madsen, Oster, Gay.

The track schedule is:

April 21—Kansas Relays.

April 27, 28—Drake Relays.

May 12—Wisconsin at Madison.

May 19—Northwestern at Minnesota. Also Minnesota State Interscholastic Track Meet at Northrop Field.

May 26—Iowa at Minnesota.

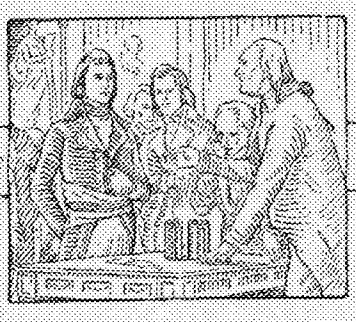
June 1, 2—Conference Meet at Ann Arbor.

June 15, 16—National Collegiate Meet at Chicago.

GYMNASTICS

Minnesota has always been represented by a strong gym team. This year's team is no exception to the rule. At the recent conference meet at Columbus, the Gophers managed to carry away third honors. Wisconsin was first with 1,114 points; Chicago second with 1,113; and Minnesota third with 1,096. Perlt and Carlson were the only Gophers to place; Perlt with a first in the parallel bars, and Carlson third in tumbling. Eight men made the trip to Columbus. Of these eight two were Engineers, Weyer and Monsen.

In the Northwestern Gym meet at the University Armory, April 14, the Gophers end their gymnastic season. The Minnesota team last year carried off first honors in the Class "A" events, and hope to repeat this year.



VOLTA EXPLAINING HIS BATTERY TO NAPOLEON

How Electrical Engineering began

IT IS not enough to experiment and to observe in scientific research. There must also be interpretation. Take the cases of Galvani and Volta.

One day in 1786 Galvani touched with his metal instruments the nerves of a frog's amputated hind legs. The legs twitched in a very life-like way. Even when the frog's legs were hung from an iron railing by copper hooks, the phenomenon persisted. Galvani knew that he was dealing with electricity but concluded that the frog's legs had in some way generated the current.

Then came Volta, a contemporary, who said in effect: "Your interpretation is wrong. Two different metals in contact with a moist nerve set up currents of electricity. I will prove it without the aid of frog's legs."

Volta piled disks of different metals one on top of another and separated the disks with moist pieces of cloth. Thus he generated a steady current. This was the "Voltaic pile"—the first battery, the first generator of electricity.

Both Galvani and Volta were careful experimenters, but Volta's correct interpretation of effects gave us electrical engineering.

Napoleon was the outstanding figure in the days of Galvani and Volta. He too possessed an active interest in science but only as an aid to Napoleon. He little imagined on examining Volta's crude battery that its effect on later civilization would be fully as profound as that of his own dynamic personality.

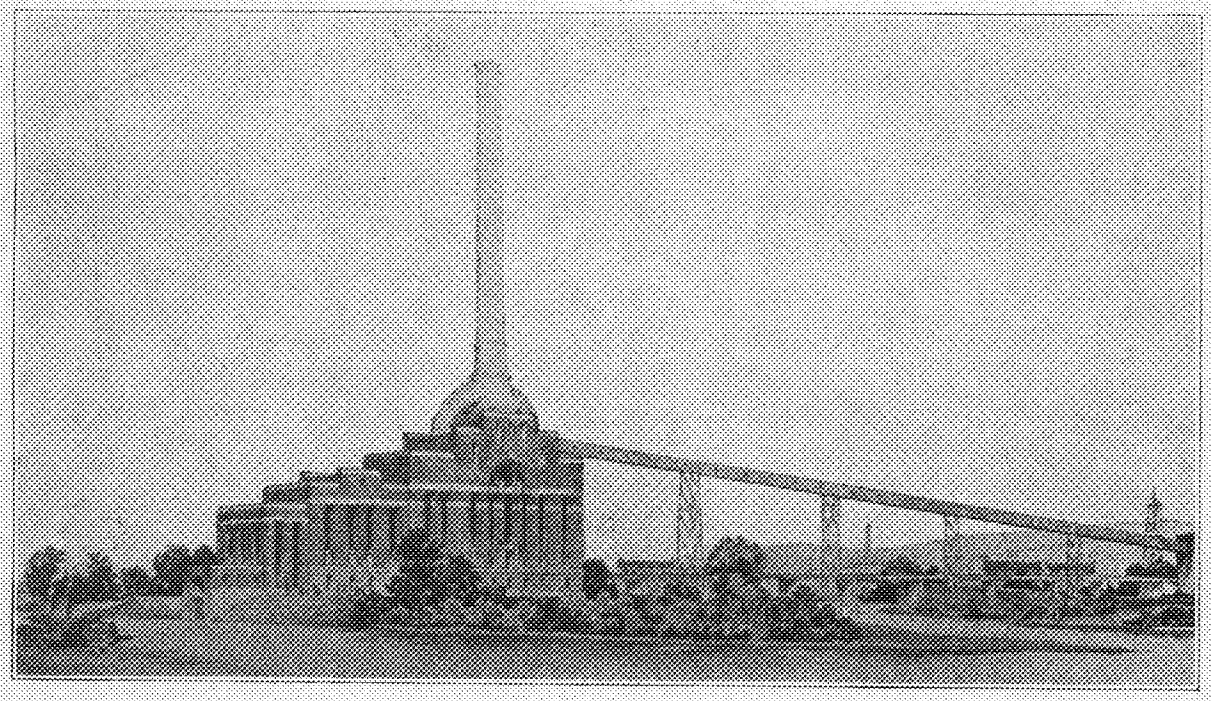
The effects of the work of Galvani and Volta may be traced through a hundred years of electrical development even to the latest discoveries made in the Research Laboratories of the General Electric Company.

General Electric Company

General Office *Schenectady, N.Y.*

95-635 D

MINNESOTA TECHNO-LOG



MAY 1923

PUBLISHED MONTHLY DURING THE SCHOOL YEAR BY THE STUDENTS OF THE COLLEGE OF ENGINEERING AND ARCHITECTURE AND THE SCHOOL OF CHEMISTRY.

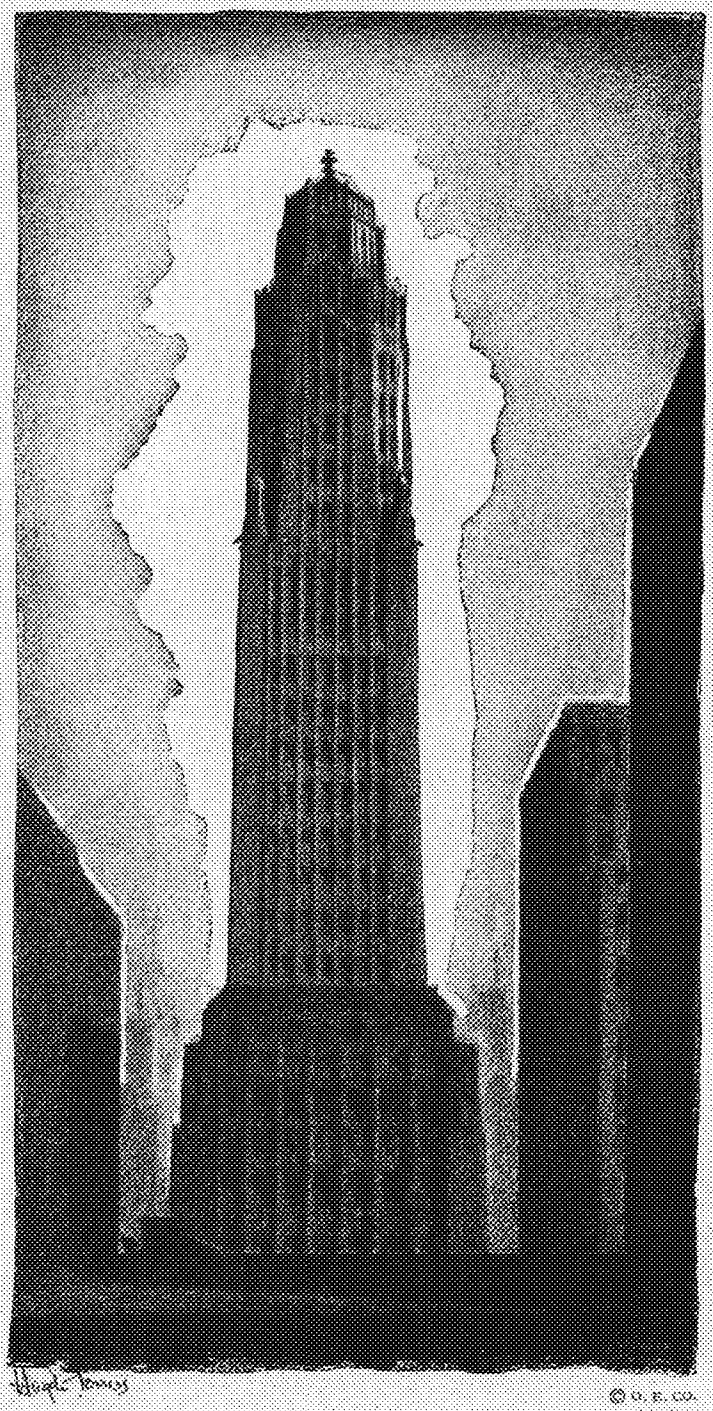
VOL. III UNIVERSITY OF MINNESOTA NO. 7

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

The Bush Building
New York City

HELMLE & CORBETT,
Architects

Drawn by Hugh Ferriss



© O. E. CO.

"A Noble Profile"

FAR more strongly than most churches, this great tower of commerce bespeaks the real spirit of Gothic architecture—aspiring, rugged, virile—an inspiration for the thinking, creating architect of today. Contradicting the antiquarian, this great tower declares that the spirit of Gothic architecture is a living, organic thing, adaptable to modern problems of accommodation and engineering, and endowed with a future as magnificent as its past.

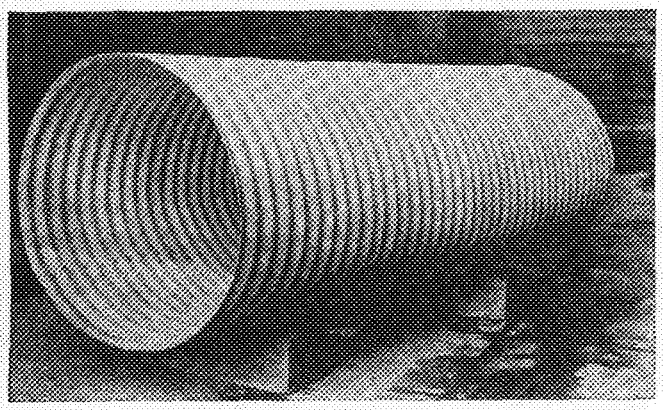
Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

OTIS ELEVATOR COMPANY

Offices in all Principal Cities of the World

Your Two Questions About CULVERTS

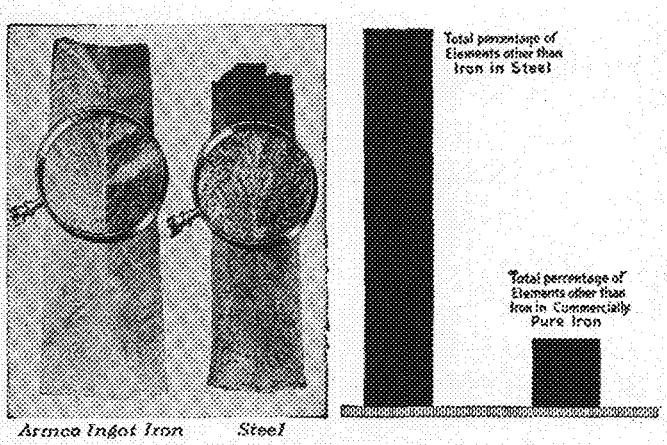
Are they strong?



Proved Practically Uncrushable by Laboratory Tests

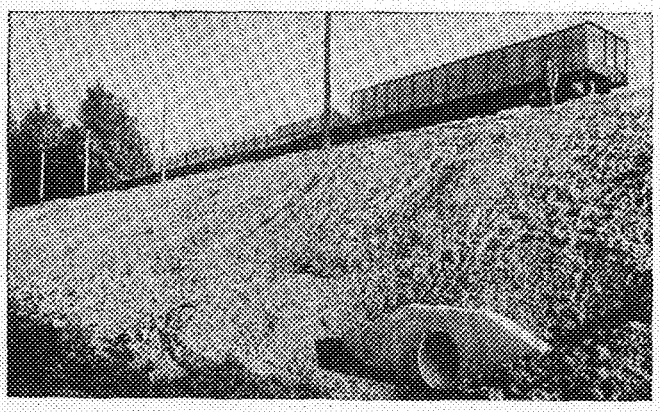
This stock Armco Culvert, 8 feet long and 36 inches in diameter, tested by Prof. Talbot of the University of Illinois, carried a load of 92 tons (11½ tons per foot) without fracture or loosening of the joints.

Will they last?



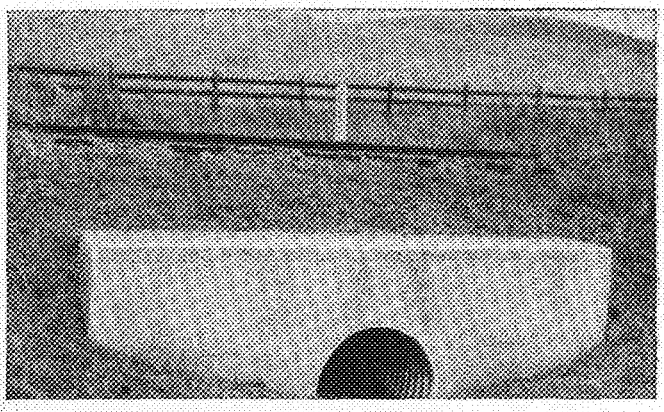
Rust-Resisting Because Made of PURE IRON

Iron to be rust-resistant must be pure in analysis, and smooth in section—free from gases. The diagram shows how Armco Ingot Iron compares in section and composition with ordinary steel.



Used Under Tons of Earth In Deep Fills

Armco Culverts are in frequent use under fills as great as 80 feet. The corrugated construction, ample gauge, and patented method of jointing give them the strength to carry these enormous loads.



The First ARMCO Culverts (1909) Are In Perfect Condition

This culvert, installed thirteen years ago under the tracks of a prominent transcontinental railway, shows no sign of deterioration today.

ARMCO CULVERTS

ARMCO Resists Rust Ingot Iron

LYLE CULVERT & ROAD EQUIPMENT CO.
171 27th Avenue South East
MINNEAPOLIS

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MINNESOTA TECHNO-LOG

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University of Minnesota

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ELECTRIC TRANSMISSION CABLES

Underground Distribution Has Become An Important Factor in Central Station Systems

By R. E. Burlingame

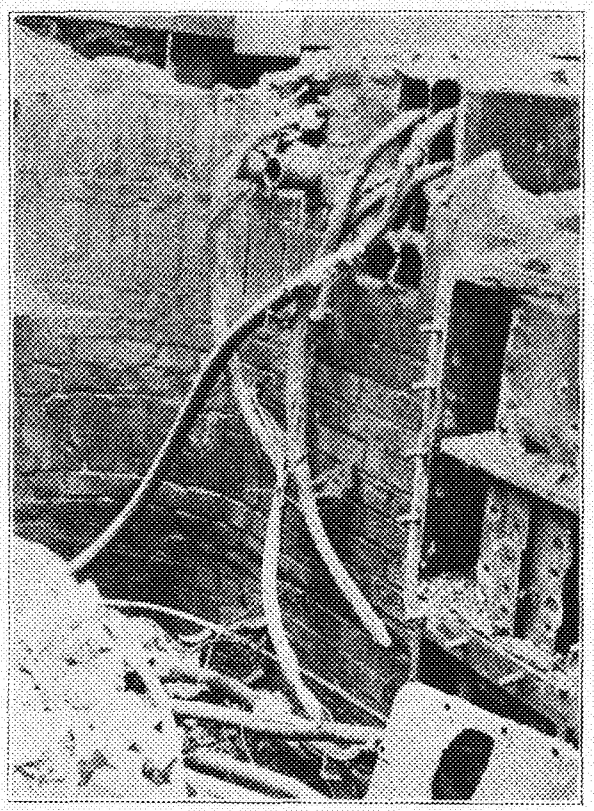
An underground system for transmission and distribution of electricity has become an important link in the modern central station system. In Minneapolis there were 476 miles of underground cables in operation in 1919. All stations and substations in Minneapolis are connected by tie lines which operate at 13,200 volts and are practically all of the underground cable type. Many 2,300 and 4,000 volt feeders are wholly or partly of the underground variety. In the business district of Minneapolis all of the electric light and power lines are underground. These lines consist of the three wire 110-220 volt direct current system, the 500 volt direct current power system, 110-220 volt alternating current mains, 2,300 and 4,000 volt primary feeders and mains, 13,200 volt tie-lines, and series arc-light circuits. Nearly all of the downtown streets and many alleys have a duct tube system under them, in the passageways of which are installed the insulated, lead covered cables serving the business district. At nearly all street intersections and at many other places splicing chambers, commonly called manholes, are installed to provide for pulling in, splicing, repairing, and inspecting cables.

The cables used are all of the lead covered type with the exception of a few grounded neutral cables. The sizes of cable conductors used vary from 6 B. & S. gauge to a 127 strand cable of 2,000,000 circular mils cross-sectional area, the latter having a diameter of about two inches. The cables contain one, two or three conductors, all of which are insulated from each other and from the lead sheath. The rating of this insulation is from 600 to 17,000 volts, depending upon the operating pressures they are to be used for. Cables of higher ratings can be obtained from the manufacturer for use on systems running at higher pressures than are used in Minneapolis. The insulating materials used are oil-impregnated paper, varnished cambric, and rubber.

The Edison tube, now obsolete, consisted of copper rods contained in an iron pipe and surrounded by insulating compound which insulated the conductors from each other and from the pipe. The last few Edison tubes in Minneapolis will go out of service this year.

To install a lead-covered cable in a duct-line requires several operations.

The first operation is that of "rodding," in which are employed hardwood rods with coupling devices at each end. One rod is started into the duct-tube where it opens into a splicing chamber. Another rod is coupled to it and pushed along with the first one, and this process is repeated until a continuous next chamber. There a steel line, with which the cable is pulled in, is attached and is pulled back with the rods as the rodding process is reversed. By means of a winch and pulleys, the cable is pulled from the reel into the duct-tube. In attaching the steel pulling line to the cable, two types of hitches are used. One type is known as a "lead hitch," and is called that because a steel wire grip or "horsetail" attached to the pulling line grips the lead sheath at the end of the cable to be pulled in. This "horsetail" is made of woven stranded steel wires in

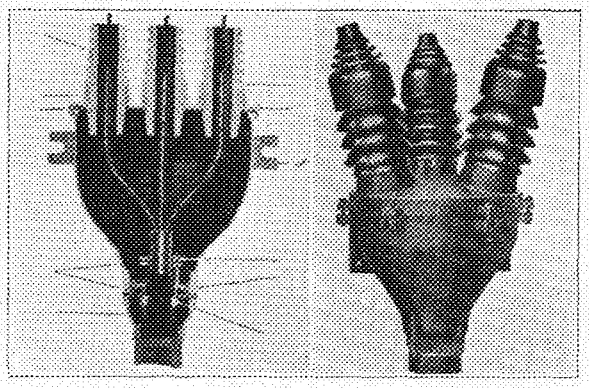


The Effect of a Duct-line Explosion. Note the Condition of the Burnt-out Cables

such a way that the strength of its grip is dependent upon and proportional to the pull on it.

In case the cable pulls so hard that a lead hitch fails, a "copper hitch" is used. In this case, the copper wire strands of the cable are separated for a short distance at the end of the cable, are slipped through the ring on the end of the steel line, and are twisted or braided back upon the cable. The cable is installed in sections which reach from one splicing chamber to the next and allow a few feet extra for splicing and racking the cable in the man-

After the cable is pulled in, the sections must be spliced together in order to make one continuous insulated cable. This is done by cable-splicers and their helpers. The lead and insulation are stripped back at the cable ends and the copper conductors are joined with split copper sleeves, the joint being well soldered and all sharp corners or projections on the splice being smoothed down. This joint is well insulated and is covered with a large lead sleeve, which is joined at the ends to the lead sheath of the cable by means of a wiped lead joint similar to that used by plumbers in joining lead pipes. The space between the insulated joint and the lead sleeve is filled with melted insulating compound. The insulation on the soldered joint is built up of paper tape, varnished cambric tape, and rubber tape in splices on cables operating on pressures up to 6,600 volts. In splices on 13,200-volt three-conductor cables the conductors are separated from each other and from the lead sleeve by means of an assembly of mica tubes called a "conducell," each conductor being in a separate mica tube. The lead sleeve and insulating compound are used in the same way as in other types of splices. After the cables are



Section and Elevation of a Pothead

spliced they are "racked up" on racks or shelves which are installed on the walls of the splicing chamber. Next, the lead sheath is bonded to other cables and is connected to ground rods by soldering a wire to the sheath and connecting this wire to a bonding and grounding wire common to all of the cables in that manhole. In many cases, each cable in the manhole is covered with a coating of wire lath and cement which will protect it from fire and heat in the event that any other cable in the same splicing chamber should burn out. The final step in the installation of a cable is to tag the cable in each manhole through which it is routed. The tags bear the numbers, etc., identifying the cable and indicate the voltage at which it is to operate.

The duct-lines in which the cables are installed are built of several types of duct-tubes. The McRoy tile duct is a vitrified clay tube made in single and multiple compartment types. It is square on the outside and either square or round on the inside. The single tube type is made in 18-inch lengths, with a round interior having a diameter of about 3½ inches. The multiple ducts are made in two, three, four, and six compartment types, and have a length of from 2 to 3 feet.

The fibre tube is round both inside and out, and is made in sizes of 2½ to 5 feet in length and 1 to 4 inches in diameter. The tubes are provided with couplings or collars of threaded, taper, or straight

Iron pipe is used for short runs, such as for underground services to buildings or for a run to a pole, and a standpipe up the pole to accommodate a cable connecting with overhead lines.

Another type of duct, which has not been installed for a long time, but some of which is still in use, is the Dorsett duct. This duct was made of a material similar to asphalt in appearance, and was in the form of long blocks containing several round passages in each.

In a few cases, as in that of the series incandescent lighting system around Lake of the Isles and the other park lakes, a jute-covered, lead-sheathed cable is buried in the ground with no other protection than that afforded by its covering.

Other types of underground duct-line construction, such as concrete conduit, wooden built-in conduit, vitrified clay trough conduit, and wooden "pump-log" conduit, are being used or have been used in other cities.

In the installation of McRoy tile ducts and fibre ducts, the tubes are laid end to end on a base of wet concrete and are covered with concrete so that each tube is surrounded by it. Usually several lines of tubes are laid parallel to each other to form a layer of ducts. After a layer is covered with concrete, additional layers can be laid on top of it to give the desired number of ducts. Under downtown Nicollet Avenue there are six layers of six McRoy tile ducts each, making a total of thirty-six tubes. Every duct-line must be laid with a slope or grade to it in order to properly drain off any water which appears in the duct-line. The line may run at a constant grade from one manhole to the next, or it may have a high point between manholes and grade down towards each manhole. If the street has a suitable grade the ducts may be laid parallel to the surface of the street, thus running at the same grade as the street. Often there are obstructions which make difficult the installation of a duct-line which will drain. Gas, water, and sewer pipes and services, as well as duct-lines of telephone, telegraph and street railway systems, may be located so as to make it necessary to use considerable ingenuity in setting the grades for the line. The grade may change a dozen times or more in a block in order to go over some obstructions and under others, and the grades used must be such that there will be no low spots or pockets to hold water.

One difficult piece of duct-line work is shown in a picture accompanying this article. The grade of the street was being lowered considerably and over 800 feet of the duct-line had to be lowered, the maximum lowering being eleven feet. The lowering process took one week, and nine 13,200-volt cables in the duct-line were in continuous operation during the whole process of lowering.

Where a connection is to be made between an underground cable and an overhead line, a pipe in which to pull a piece of cable must run from the nearest manhole to the pole, and nearly to the top of the pole. A large pipe-bend is used at the base of the pole to connect the horizontal and vertical pipes. This bend makes it possible to pull a lead-covered cable into the pipe.

The splicing chambers, or manholes, are of various sizes, the largest being about 8 feet by 10 feet with a height of about 6 feet. The walls are made of red sewer brick, are 12 inches in thickness, and rest upon concrete footings. When the manhole is

in the walls to provide sockets for "double angle" or T-irons. These T-irons support reinforced concrete slabs or shelves upon which the cables will be carried along the walls of the manhole. The ceiling or top of the manhole is made of steel T-rails, bricks, and concrete, and is strong enough to support the largest trucks in use. In this top is set the iron manhole casting in which the cover casting sets. The cover castings used are of two types. One type is the solid cover, and the other is the perforated cover, which has holes for the ventilation and cooling of the manhole.

The floors of the manholes are plain earth floors, which allow water to drain away into the ground rather than to collect in the manhole.

In addition to the duct-lines, manholes and cables, a considerable amount of other equipment is necessary to make a complete underground electric system. The most important items of this equipment are junction boxes, potheads, transformers, and cutouts.

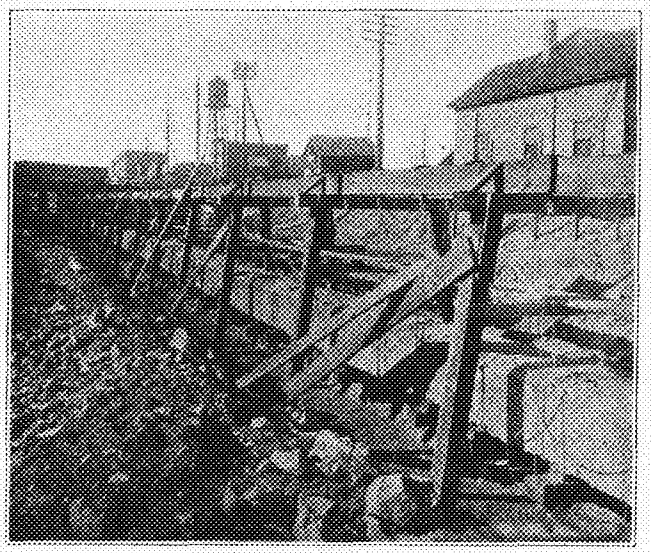
Junction boxes are used in the downtown direct current system. They consist of a watertight cast-iron box containing a marble slab which carries two busbars. One busbar is positive and the other is negative, and each one is equipped with cap screws and washers under which one end of a copper fuse link is clamped. The other end of the fuse link is fastened under a similar cap screw and washer located on a terminal lug sweated to the end of a cable main. Two 1,000-ampere fuse links are used as one, thus making the equivalent of a 2,000-ampere fuse. About a block or so down the street the other end of the cable mains going in that direction connect in a similar way to the busbars of another junction box. All sections of the cable mains are connected together by means of junction boxes, thus forming a network of mains covering the whole direct current district. Part of the junction boxes are known as feeder junction boxes. Feeders of 2,000,000 circular mils cross-sectional area coming directly from the direct current substations are connected to the bottom ends of the busbars in these boxes and feed into the network of mains at these points. The number of feeder junction boxes in any small part of the system is proportional to the concentration of the load in that locality. Pressure wires run from each feeder junction box back to a voltmeter on the switchboard to which the feeder is connected, thus giving the voltage at the "feed point" of the cable.

Potheads are devices used where a connection is made between an underground cable and overhead lines or station wiring. It consists of a cast-iron pot through the bottom of which the cable end comes up, and a top or cover provided with insulator bushings through which the exposed wires enter. The necessary splices are located inside of the pot. The lead sheath of the cable is stripped back a few inches and is gripped in a clamping ring provided at the bottom of the cast-iron pot. The cable insulation is stripped back part way and the copper conductors joined to the end of the exposed wires. The splices are individually insulated, are separated, and the cover with its insulators is slipped down over the exposed wires and is screwed down to the top of the pot casting. Melted insulating compound is poured into the pothead through a filling-hole in the cover, filling the space between and around the insulated splices. The pothead cast-

it may be rigidly fastened with lag screws or bolts to a pole crossarm or a station wall.

In cases where a customer is to be supplied with 110-220-volt alternating current lighting or three-phase 220-volt power through an underground service, a subway transformer bank fed from a 2,300- or 4,000-volt alternating current cable main is installed in a manhole or transformer vault. Both subway and line types of transformers are used for this purpose. The subway type differs from the line type principally in that it is not provided with insulator bushings for the leads, but instead are built to accommodate lead-covered cables which enter the transformer case and are connected inside to the transformer terminals.

Sometimes power customers have underground services from a subway transformer bank fed from an overhead high-tension main through a pothead



Method of Lowering the Position and Grade of Duct-line

and cable. This type of installation is often used for shops and factories in districts which are served by overhead lines.

Provisions for protection from overloads, short-circuits and grounds are necessary for all transformers. This protection is obtained by the use of high voltage fuse cutouts on the high voltage side of the transformer in the case of subway installations. Several types of cutouts are used.

One type which is used a great deal consists of a watertight cast-iron box containing a porcelain block upon which are mounted suitable clips and connection screws. A porcelain fuseholder with clips to take a 2,300-volt cartridge fuse has knife-blade contacts at its ends to fit the contacts on the block, and is provided with a porcelain handle to make removal easy. The cutout can be used both for protective and disconnecting purposes.

The oil-filled cutout has a submerged fuseholder on which a wire or strip fuse is used. When the fuse is melted, the oil quenches any arc which forms. The cutout will safely break a considerable current at 2,300 or 4,000 volts and can be used both for protective and disconnecting purposes.

On subway transformer banks feeding from an overhead line, additional protection is often provided by installing line types of cutouts between the overhead lines and the pothead.

In the downtown direct-current system, protec-

A NEW POWER PLANT FOR ST. PAUL

Gas Company to Enlarge Capacity 100,000 Kilowatts With Station on Mississippi Island

By Donald C. Swift

IN THE large improvement program which the St. Paul Gas Light Company plans to carry out in the next few years, a new steam power plant with an ultimate capacity of 100,000 kilowatts is a large factor. This new plant is to be located on an island in the Mississippi River between the Omaha and High bridges and only a short distance downstream from the Omaha bridge. The St. Paul Gas Light Company has owned this island for a number of years and the location is regarded as being exceptionally favorable for a power plant. River water is immediately available for condensing and good trackage facilities are present, as the Omaha line runs within a stone's throw of the plant.

In consideration of St. Paul's present rate of growth, it is planned to install a 20,000 K. W. unit at first and to expand the plant's capacity by the addition of other units as they are needed. This program will enable the St. Paul Gas Light Company to meet adequately new power needs which may result if the industrial boom, which is expected to follow the location of the Ford plant in St. Paul, materializes. This is in line with the Gas Light Company's progressive policy of anticipating the city's needs so that they may be taken care of as they develop.

The plant, with an ultimate capacity of 100,000 K. W., is expected to cost in the neighborhood of $1,500,000. D. W. Flowers, General Superintendent and Chief Engineer of the St. Paul Gas Light Company, is in general charge of the plans and construction of the plant. Toltz, King & Day, St. Paul, have been engaged as consulting engineers for the work and will design and superintend the construction of the plant. James F. Muir, mechanical engineer for this firm, is in charge of the mechanical design.

Most of the equipment for the plant was purchased by Mr. Flowers in the East a short time ago and Toltz, King & Day are now working on final plans for the plant. The George Grant Construction Company has the contract for the excavation and piling, which will cost in the neighborhood of $100,000. Work on this part of the plant has been going on for about a month and is well under way. This work is being rushed at top speed so that it may be in good shape by the time the high spring waters arrive. The average level of the island is 710 feet, while the river level at low stage is 704 feet and at high stage is 726 feet. This necessitates that the excavation work be pushed as far as possible before the island is flooded. It is expected, however, that high water will delay the construction work somewhat.

The power plant building will be of brick and concrete construction with steel reinforcing and will be fireproof throughout. It will be 78 feet wide and approximately 220 feet long. Three partitions running crosswise of the building will divide it into four parts. The first, 25 by 78 feet, will be the pulverized fuel preparation room. The second, 95 by 78 feet, will be the boiler room. The next part, 60 by 78 feet, will house the turbines and generators. The fourth part, 28 by 78 feet, will be the switch [illegible] dating on the top floor a switchboard and benchboard. The third floor will house the oil switches and switch gear. On the second floor will be housed the electrical connections, and the transformer equipment will be located on the bottom floor. At the west end of the switch, space is provided for general offices for plant administration. The building will be about 90 feet above low river level. A steel stack, lined with insulating material and 16 feet in diameter, will tower 260 feet above the firing floor of the plant. This one stack will serve 4 boilers and will be located at their central axis.

Pulverized fuel will be used and the most efficient equipment for handling and burning it will be installed. From the cars, the coal will be raised by means of a skip-hoist to a feeder bin and from there will be sent by belt conveyor to the raw coal bins in the plant. From these bins it goes to dryers, which remove all moisture above 2 per cent. From the dryers it travels to the pulverizers. Here it is ground to a fineness such that 80 per cent of the coal will pass through a 200-mesh screen. From the pulverizers, the fuel is discharged to an overhead cyclone collector by means of a suitable blower and is then distributed to the pulverized boiler feeder bins by means of screw conveyors. A mixture of pulverized fuel and air is fed to the boiler through a feeder mechanism, the necessary air blast being provided through suitable ducts from a blower. The mixture burns with an intense heat and with very little ash remaining. "Lopulco" equipment, manufactured by the Combustion Engineering Co. of New York, will be used in the firing system. The walls of the boiler will be air-cooled. Air enters at one side, travels around the boiler setting and enters the furnace at the opposite side. In this way, radiation, usually lost, is used to promote combustion of the pulverized fuel. The latest design super-heaters will be installed. Great economy and a flexibility almost as great as with oil burners is claimed for the pulverized fuel system.

Haney boilers, rated at 1,044 H. P. each, will be used and these will be operated at times to 325 per cent of their normal rating. According to present plans, three of these boilers will be installed for the first two years and a fourth will be added in the third year, making the first power plant a complete unit of 20,000 K. W. capacity. A Westinghouse 20,000 K. W. turbine generator unit with electrically-driven auxiliaries has been purchased. A Westinghouse surface condenser will also be used, which requires 36,000 gallons of circulating water per minute. This water will be obtained from the river through suitable tunnels passing under the boiler room.

In addition to this new power plant, which will cost approximately a million and a half dollars and will be completed early in 1924, the St. Paul Gas Light Company plans to spend an equal amount on new lines and equipment. Line extensions, new meters and additional transformers, necessary to care for St. Paul's growth, will require $1,500,000 for 1923, it is expected.

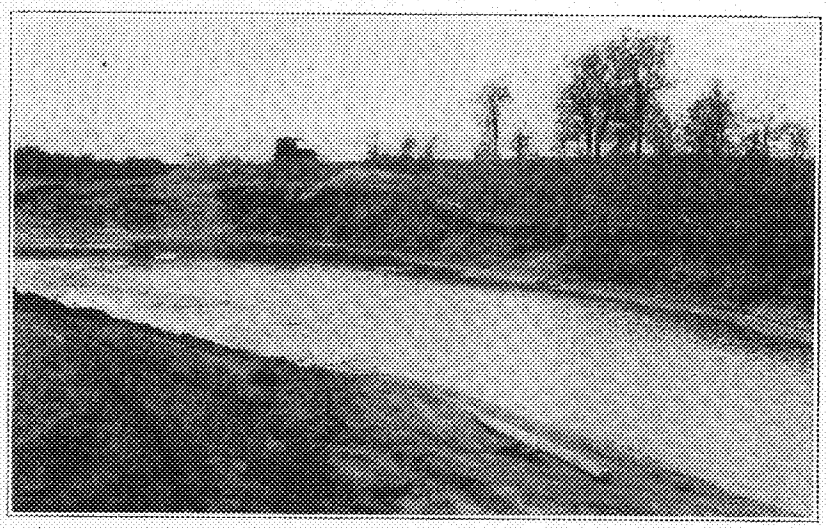
USES OF MARL FOR STATE ROADS

Latest Bulletin of the Engineering Experiment Station Prove Feasibility of This Material

By L. A. Tvedt

THE Minnesota Legislature at its session in 1921 provided funds for the investigation of various possible uses of marl. Two phases of this work were carried out by the Engineering Experiment Station of which Dean O. M. Leland, of the College of Engineering and Architecture, is director. Bulletins No. 1 and No. 2 are the first to be issued by the Station and give the results of the investigations relating to the use of marl in road work and in the manufacture of Portland cement. Bulletin No. 1, "The Use of Marl in Road Construction," is by Charles H. Dow, and No. 2, "The Manufacture of Portland Cement From Marl," is by Raymond E. Kirk.

As defined by W. S. Blatchey, state geologist of Indiana, "Marl is a soft, earthy material composed principally of an amorphus form of carbonate of lime," or it is limestone in a finely divided form. The color of marl varies due to impurities and to chemical and physical changes that take place when it is exposed to the air. It may, in the wet or damp state, range from a milky-white to a dark brown. A light colored marl upon being exposed to the air a short time turns a bluish or drab color. As drying and certain chemical changes, due to exposure to the air, take place, the color tends to lighten again but usually does not get lighter than a drab. Pure marl however, may be very nearly white when dry. The grains of marl vary from fine powder to coarsely granular and cohere rather loosely.

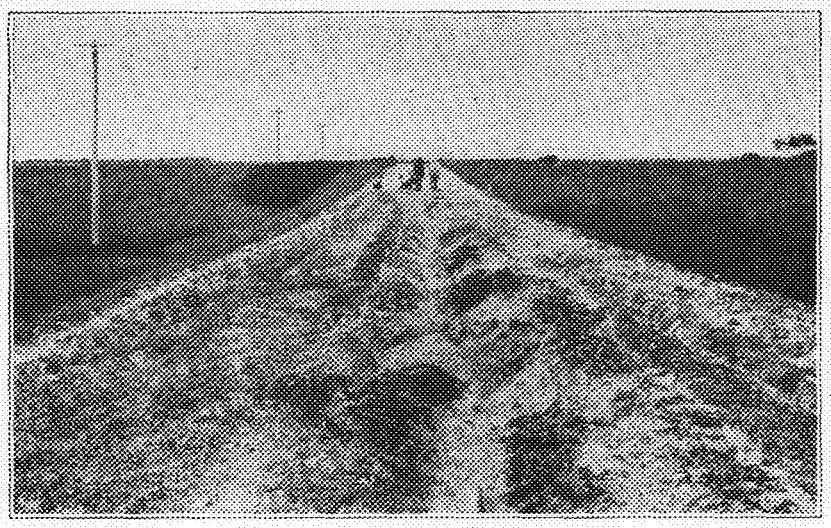


Marl Deposit in Minnesota

Deposits of marl in Minnesota are numerous, but none of them are, relatively speaking, very large. However, there is the possibility of many undiscovered deposits and even an underestimation of the size of some of the present known deposits. With the exception of a deposit at Glencoe and two or three in Hennepin and Anoka counties all the deposits are found north of the south line of Benton County. In an east and west direction the deposits are scattered from St. Louis County to the Red River of the North. While several theories prevail as to the origin of marl, Mr. Blatchley is of the opinion that clays deposited by glaciers are the immediate source of marl—these clays being "rich in finely divided limestone and other soft rock forming materials, many of which contain the components of marl. "Water containing carbon dioxide, when cool and under pressure, dissolves the carbonates and holds them in solution until it issues forth as a spring in the side or bottom of a lake. Then the carbon dioxide escapes, the pressure is reduced, the spring water rises in temperature and the excess of the dissolved material is precipitated in the form of a white powder." The deposit at Rice is a pocket covered with ordinary soil. Springs are, however, still issuing through it. Other deposits extend back under peat beds as on the shore of Long Lake. The marl may exist in various stages of solidity varying from semi-liquid to firm. Impurities in marl are organic matter, sand, and clay, although for some uses of marl these impurities are of little importance.

This article will not go into the purely technical discussion of the experiments, but will attempt to give a few general ideas on the subject matter of the bulletins and the results of the experiments and investigations.

It has been an accepted practice to improve many of Minnesota's sandy roads by the addition of clay and the thorough mixing of this clay into the sand of the subgrade. The fortunate situation of many of the marl deposits in the vicinity of sand roads, and the similarity of the "binding" properties of clay and marl, has suggested its use in place of clay. Experimental roads were constructed in 1922 after laboratory tests had been made in order to determine some general properties of sand-marl mixtures. One of the experimental roads was at Rice, and a few details of the construction of this road will be given to illustrate the general procedure. This road was divided into four sections for the purpose of determining the best way of applying marl as a surfacing material. Section No. 1 was covered with marl to a depth of 6 inches and not subjected to further treatment except shaping and packing. As was anticipated, this method did not give a satisfactory surface, but it demonstrated the incorrect way to apply the marl. Section No. 2 was spread with three inches of marl and six inches of sand and the two were thoroughly mixed by plowing. Section 3 had four alternate three-inch layers of marl and sand. Section 4 had a five-inch layer of marl and six inches of sand. Sections 3 and 4 were mixed in about the same manner as No. 2. The road surface was then shaped by the use of blade machines and then packed by allowing traffic to travel over it or by running a heavy truck with wide tires back and forth until the entire surface had been covered. Ruts



Marl Road Under Construction

care of by the maintenance crew. Indications are that marl-sand roads would require less maintenance in early stages than gravel roads. Continued travel tends to improve the homogeneity of the mixture and the general surface of the road. After a period of dry weather the dust formed became somewhat excessive, but this was overcome by either of two treatments.

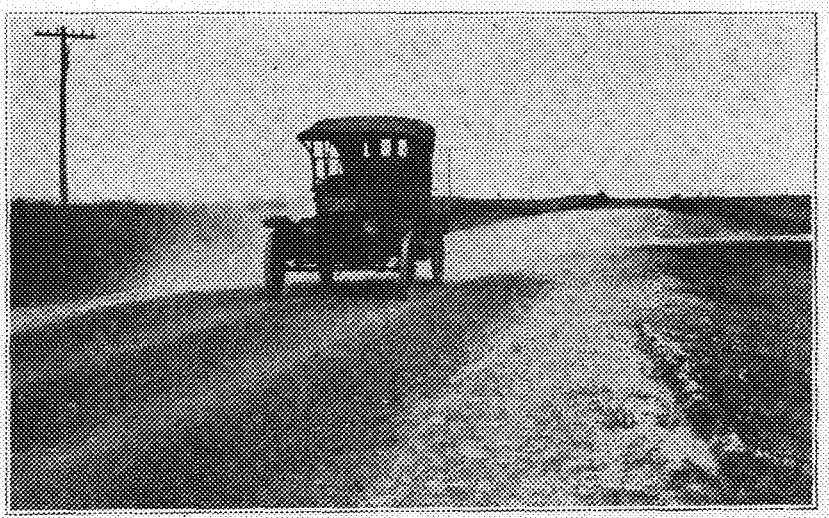
A fine gravel blanket with a thickness of a little less than an inch was spread on one section, and calcium chloride was put on the other. Both methods were satisfactory from the point of view of overcoming the dust. The other roads were made in the same manner with the exception of slight changes made in the procedure of mixing the marl and the sand, and a few other minor details. While the period during which the experimental roads have been under observation is not very long, some conclusions have been arrived at and have appeared definite enough to report in the bulletin. If the marl is properly mixed with sand, the slab formed is satisfactory and of sufficient strength to support ordinary traffic and prevent it breaking through. The homogeneity of the mixture tends to prevent the formation of ruts and waves. During protracted dry weather dust forms in such amounts as to be rather offensive, but surface treatment can be resorted to which will overcome this objection to sand-marl roads. The surface seems to be capable of withstanding heavy rains without injury; in fact, the roads seem to remain in best shape during periods of frequent rains: as contrasted to clay-sand roads, which are at their best during dry periods. The writer of the Bulletin says in his conclusion that, "We may say that marl compares very favorably with clay and is superior in some respects as a surfacing material for roads." While in some cases the roads did not at first meet with the entire approval of the public, it can now be said that they are considered very satisfactory and in some localities search is being made for new deposits with a view of making general use of marl in road surfacing operations.

The possibility of the manufacture of Portland cement from marl may, [illegible] of the interest which often-

times attaches itself to large scale manufacturing processes, appeal to part of the public as being a rather real one, but from the conclusions given by Mr. Kirk in his report we can hardly expect this use of marl to be carried out in Minnesota. Despite reports to the contrary, Portland cement made from marl and clay is of as good a quality as that made from limestone; but for economic reasons the use of limestone should be favored where it is available in proper quantities. The cement industry is a large scale industry, requiring a large amount of capital and a plentiful supply of raw materials near at hand for efficient operation. It has been estimated that a deposit 320 acres in extent and 20 feet in depth would be necessary to supply a 2,000-barrel plant for thirty years. But at present no such deposits are known to lie within the State, and it is this factor of the limitation of the quantity of marl in any one location that will govern the location of possible cement mills in the future. As Mr. Kirk says in his conclusion: "There is no evidence at hand to show that Minnesota contains deposits of limestone of sufficient extent and of the proper character to warrant the establishment of a Portland cement plant," and he recommends that a very careful investigation be made as to the character, extent and location of the larger marl deposits before any other steps whatsoever are taken toward the use of marl in Portland cement manufacture.

A third use of marl has been investigated by Dr. F. J. Alway, Chief of the Division of Soils, namely, the use of marl in treating acid soils. There are several factors which indicate that this may become one of the major uses of marl in Minnesota. One is that marl deposits are found in that portion of the State which has acid soils to combat. The deposits that can be utilized in this manner need not be large to supply the demand in any one locality. Neither does it have to be pure; in fact, any organic matter that might be present would be beneficial to the soil.

Other potential uses of marl that may be investigated and found possible are its use in the making of lime, sulfite liquor, whiting and similar products.



Completed Marl Road

PROCESSES OF STEEL MANUFACTURE

Various Methods Used to Obtain a Pure and Non-Corroding Product Are Explained

By J. D. Frazer, '09

THE tremendous losses due to the corrosion of iron and steel have led to a careful study of the processes involved in the manufacture of these products with the view of overcoming some of the conditions which have made iron and steel an easy prey to corrosive elements. When it is considered that in 1921, according to Sir Robert Hadfield, the losses from corrosion equalled in tonnage the iron and steel manufactured during the year, the necessity of some improvement in product is obvious.

Recent scientific investigations have indicated beyond any question of doubt that the purity of an iron determines its rust-resisting properties. Proceeding upon this proven fact, some manufacturers have given considerable thought and attention to the development of the process of manufacture of pure iron in commercial quantities. The development of this process represents a very fascinating study, but this treatise will permit only a brief reference to the subject.

When steel came into general use and the demands for tonnage became tremendous, the Catalan forge and other more or less crude methods of producing steel were entirely inadequate to meet the demand. The first step in the development of modern manufacture is found in the Bessemer process. In the Bessemer process it is necessary to start with pig iron in the molten condition. This molten pig iron is poured into a pear-shaped vessel called a converter and a heavy blast of air is blown through it through holes in the bottom of the converter. This air, instead of cooling the metal as might be expected, burns out the impurities and actually increases the temperature of the metal. In fact, it is usually necessary to add some large pieces of steel scrap at the end of the "blow" in order to cool the metal to some extent.

While the Bessemer process made possible quantity production of steel, it is unfortunate that this blast of air burns or oxidizes the iron as well as the impurities, and for that reason it is impossible to carry the purification out completely without sacrificing a large amount of the iron. To overcome to some extent this super-oxidation, manganese and silicon are added to the metal before it is poured into the ingot moulds. Bessemer steel was so impure and rusted so rapidly that it has been largely supplanted by open hearth steel, which is the process now being used generally.

The open hearth furnace is what the name implies. The furnace is a large brick structure about 60 feet long and 20 feet wide and from 10 feet to 12 feet high. A charging floor is provided 4 feet or 5 feet from the bottom of the furnace. The charging doors are pneumatically operated and water-cooled. The furnace is lined with a refractory material which plays a part in the purification process. The charge consists of pig iron, limestone and scrap. Heat is provided by natural or producer gas, and the flames are introduced through portholes at either end of the furnace, being applied at the two ends alternately to insure a uniform melt. The air which is mixed with the gas passes through what is known as a checker chamber, a structure placed just beneath the furnace. This checker chamber contains brick piled one on another, and they are heated to a tremendous temperature. The air, in passing over these brick, is heated before being mixed with the gas. The ordinary open hearth heat is poured at from 2,800 to 3,000 degrees Fahrenheit.

The open hearth process produces a relatively good grade of steel. It does not succeed, however, in removing the impurities to the extent where the product might be called a commercially pure iron, because here again there is danger of super-oxidation of the iron itself if the heat is too intense, or is applied too long.

The open hearth furnace process, however, is the process which is used in the manufacture of commercially pure iron, and it is a differentiation of this process which has made it possible to put upon the market an iron which compares very favorably with the product of the old Catalan forge, which marks the beginning of the manufacture of iron and steel.

The making of pure iron by the open hearth process involves certain preventative measures. In the first place, a very high grade scrap must be used. It must be relatively free from brass. Brass contains copper, and once copper gets into an open hearth furnace it cannot be removed. The second preventative measure must be the careful selection of the coal which is used in the manufacture of producer gas. This coal must be extremely low in sulphur, else an excess of sulphur will be introduced into the bath, which would be harmful to the product. The third preventative measure is the selection of a high grade pig iron to guard against any excess of carbon. The idea of all these measures is to keep out, in so far as possible, the introduction of impurities into the furnace.

Those who pioneered the development of a modern process of manufacturing a commercially pure iron in large quantities were confronted by several facts. In the first place, they found that if the heat applied was of sufficient temperature and was applied for a sufficient period, the impurities would be all burned off, but in this process the iron was super-oxidized or burned. The secret, therefore, if there be any secret in the manufacture of modern pure iron, lies in the method of removing this excess of oxygen which is introduced in the process of purification. When a heat of this modern pure iron is poured it is really in a super-oxidized condition. As it passes into the ladle, however, powdered aluminum is added. Aluminum has a stronger affinity for oxygen than has iron, and when added to the molten mass de-oxidizes the heat, and being lighter than iron rises with the slag and leaves a relatively pure iron behind.

There are many other facts in the process from furnace to sheet which must be guarded carefully. For instance, when the contents of the ladle are

(Continued on page 33)

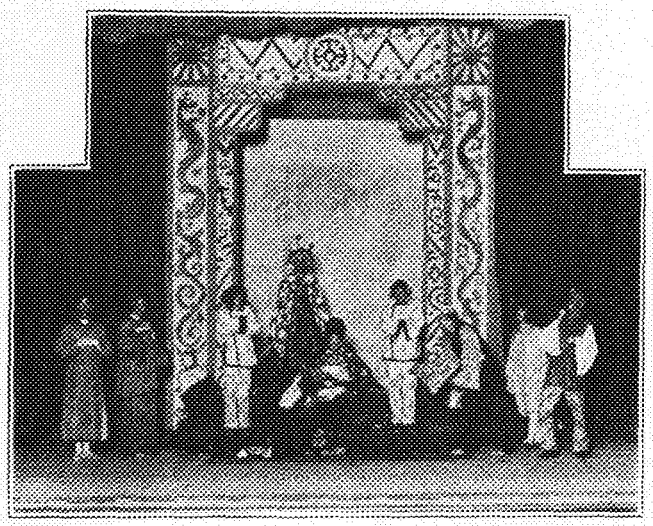
THE ARABS' CLUB PRODUCTION

'The Blue God' A Well Balanced Performance and Creditable To Both Club and University

By Ray T. Busch

THE Arabs' presentation of "The Blue God" puts the University of Minnesota on a truly representative theatrical map in the musical comedy field. If one year of experience is responsible for this excellent production we cannot hold high enough expectations for their next performances.

The rise of the curtain, upon a finely posed picture of the High Priest of the Temple of Holy Bones, against a well-lighted background and foreground,



An Incident from the First Act

gave us a feeling of dramatic regard for this production which we never lost throughout the entire performance. However, the author, Glanville Smith, refused to allow us to tire of dramatic high-lights, by giving us comedy, delicate, satiric and sometimes overly broad, until we forgot plot, music, and color in pure enjoyment of the comedy which pushed us back in our seats to chuckle every time a dramatic moment would cause us to lean forward. Smith gave us genuine entertainment; he knows how to keep an audience delicately dangling in the air between comedy and drama, gently lowering it from time to time, to listen to a full-throated chorus finish a good musical number.

The Arabs possess more scenic possibilities than any other dramatic group on the campus and they have worked to give them to us in this production. Act I showed the Upper Hall in the Temple and the Shrine of the Blue God; color here was subordinated to effective lighting and heavy draperies, and we were given a scene absolutely in key. Act II, before the Great Idol, left nothing to be desired and even here a modesty in setting was kept, rather than over-theatricalism. The Grotto scene in Act III was quietly executed and very effective. The scenic artists achieved their results this year by an excellent simplicity, and consequently again received a large share of the honors.

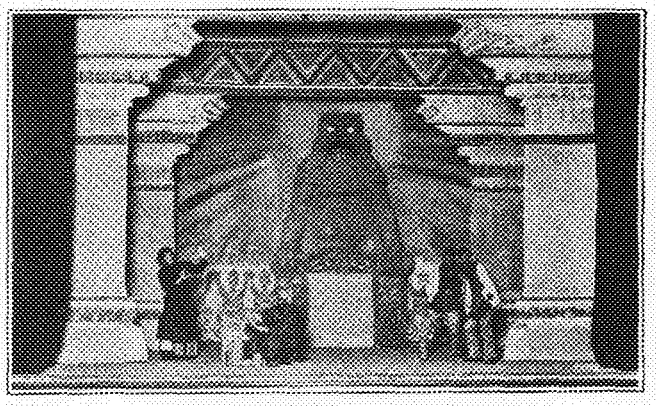
The lighting, in the hands of Richard Jones, was excellent, especially in the opening of Act I and II, and the death scene in the Grotto in Act III. This type of production especially lends itself to the lighting equipment of the Music Auditorium.

Clarence Teal, as Itchy Palm, did a very consistent piece of work. He gave us the seriousness necessary in Itchy Palm, without overplaying it, in his scene with Flim-Flam and Wim-Wam. He was most effective in the "Avarice" scene in the last act and played in a restrained key, a part which easily might be over-acted. Theodore Prichard, as Gardens-In-The-Rain, was excellent and charming through the play. He never lost the comedy of his role and proceeded to extract every bit of it with a suggestion of the tenacity and watchfulness of a Mrs. Fiske.

Wim-Wam and Flim-Flam, played by Oswald Stageberg and Edward Holien, were excellent bits of caricature. They served as devices for the author to give the contrast necessary in the broad comedy moments. Effectively costumed and made-up, they balanced the drama of the piece, as well as the stage pictures, especially in the chorus scenes.

Lima Bean and Sugar Beet, played by David Kopp and Ted Waldor, gave us good team-work and were fine, especially in their song "You're So Mean to Me" with Flim-Flam and Wim-Wam.

The Fu-Such of Roger Loucks was restrained and forceful. He has a pleasing voice and put his songs "over" nicely, but was a trifle late on some of his encore cues. The Pretty-Is of Alden Olds was a very broad but effective piece of comedy. W. Lyle



A Second Act Scene

Borst, Murray Lanpher, and Arthur Ruddy were good in their minor roles.

It was a pleasure to hear a chorus actually sing and show genuine signs of musical harmony because it is a lost art in the usual musical comedy Minneapolis receives. The music was tuneful and blended nicely into the action.

To see the "Blue God" was to enjoy it, and I found nothing to criticize. "The Blue God" was a finely-balanced entertainment and a credit to the Arabs and to the university. I trust that sometime in the future the Arabs will see fit to represent the university in musical comedy in the form of interstate tours as Haresfoot Club, of Wisconsin University, the Black Friars, of Chicago, and many others, do.

A NEW ELECTRICAL BUILDING

Plans Are Nearly Completed For The Next Unit In Ten Year Building Program

By Albert W. Morse

WITH plans ready for the contractor, the Electrical Engineering department is practically assured of having a new building by a year from this fall. This will provide adequate housing for department offices and classes, and will place on the campus one of the most attractive buildings included in the University expansion program.

In securing these new quarters, Prof. G. D. Shepardson, head of the department, will reach a goal toward which he has been striving since he came to the college in 1891. Unforseen difficulties have been encountered in the course of the years of planning, but at last a building has been assured which will be worth the effort.

The location is between the main engineering building and the Northern Pacific tracks, as finally decided upon. The front of the new unit is to be on line with the front of the main building, with the laboratory extending back in the direction of the experimental building. It is anticipated that eventually the front of the new building will be the same length as that of the main engineering building, with the addition built on to the north. The mechanical department will probably occupy this part, having a laboratory extending back parallel to the electrical laboratory. Provision is made for a hallway to pass through the entire front of the completed structure.

The front section will equal the main building in depth and height, and be of corresponding architecture. A connecting link with a hip roof will then extend back to the laboratory, which will differ slightly in architecture from the front portion. The entire structure could not be designed similarly to the main engineering building and kept within the $300,000 appropriation, so the architect conceived the idea of having a narrow, connecting link to introduce the change.

Department offices will be located on the main floor to the right of the entrance, with a seminar room on the extreme right and two laboratory and sevice rooms across the branch corridor. Space on the left is allocated to a class room, an office, a photometer room, and a stairway. Proceeding out through the connecting link, three laboratory rooms will be on the right, and on the left hand there will be in turn a janitor's closet, faculty toilet, and three offices.

Standing in the doorway of the main, two-story laboratory, a person will be able to get the finest vista on the campus, a distinction now conceded to the engineering library. Every detail is planned symmetrically, and the confusion so apparent in the present building will be entirely lacking.

According to C. H. Johnston, state architect, who designed the building, this 150x55-foot laboratory will be one of the finest located in collegiate institutions throughout the world. Its system of communicating trenches and shafts for wiring makes it exceedingly elastic. Seven vertical wire shafts built into the walls enable connections to be made freely with the different floors. Two of these are located at the front of the building, two at the junction of the front section with the connecting link, two more at the entrance of the laboratory, and one beside the elevator at the north side of the laboratory. These shafts connect with a wall trench extending around the building, which in turn branches off into lateral trenches in the floor at intervals of twenty feet. Thus a student will be able to operate machinery at any point in the building without exposing a network of wires.

An interesting feature of the laboratory will be the system of bringing in new equipment. Vans will unload onto a cement coping at the rear of the building, and the main crane will be brought into play through some double doors, eliminating the injuries to a building caused by bringing in equipment through regular entrances.

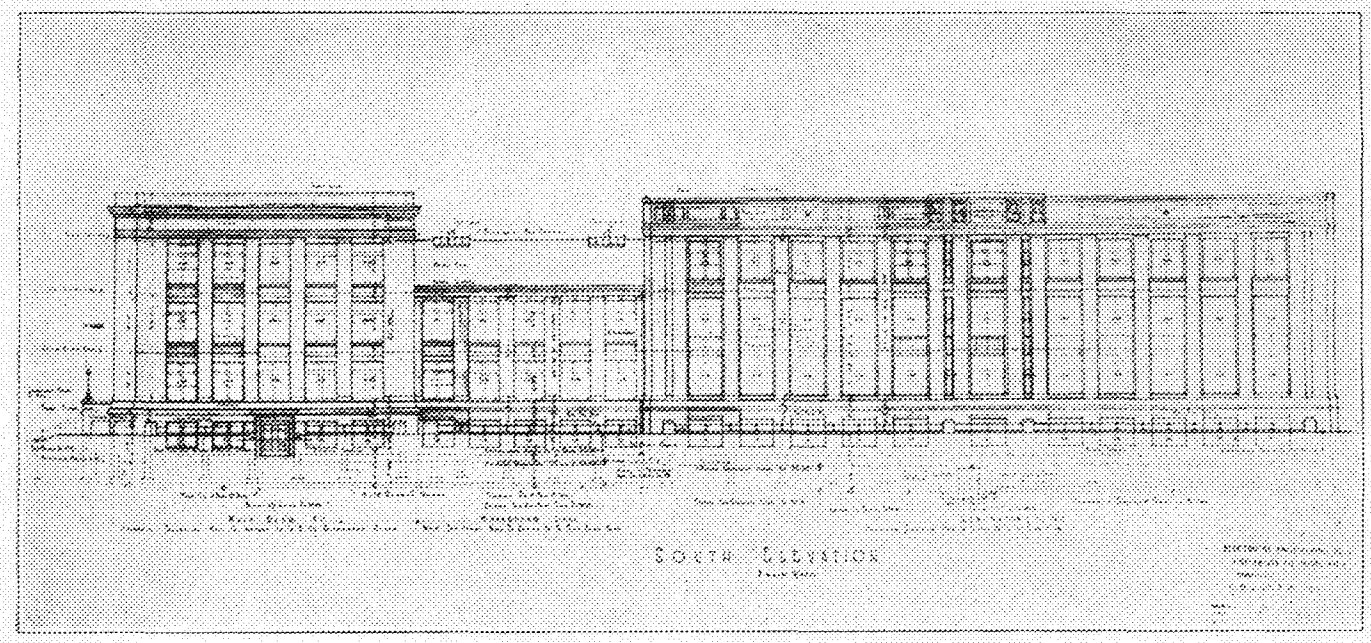
Prof. F. W. Springer is responsible in no small degree for the completeness and admirable arrangement of the laboratory. He has maintained an active interest in this work ever since his entrance into the department, which is amply testified to by his constant interest in the laboratory of the old building. A piece of apparatus developed and constructed by Professor Springer, which has been in use several years, is the portable alternating current switchboard. This was finished in March, 1912, and is still giving satisfactory service.

On the second floor, the front section will contain three unusually large rooms, devoted to classes, study, and illumination laboratory work. Here the various systems of lighting will be demonstrated, including straight direct, straight indirect, and semi-indirect. Then there will be a dark room for radio work, and the stairway. The entire right side of the connecting link will be taken up by a design room, with lateral trenches in the floor to facilitate wiring. On the left there are to be a janitor's closet, a women's toilet, and three private laboratories. The entire second floor of the main laboratory will be devoted to a gallery extending out about ten feet from the front and sides, with a narrow passage across the back.

Most of the front section on the third floor will be converted into a lecture hall. Here the student branch of the American Institute of Electrical Engineers will finally come into its own. In the past, institute members have been buffeted by the winds of fortune between the engineering auditorium and numerous rooms in the Minnesota Union. Arrangements will be made for stereopticon and moving picture facilities, and the room will be available for various lectures of interest to department members. A classroom, a photometer room, and an apparatus room are also to be located here.

Storage space will be found on the right of the connecting link, and the left side will be divided into two smaller storage rooms, a janitor's closet, and a faculty toilet.

The third floor of the laboratory will be probably one of the most complete communication-develop-



South Elevation of the New Electrical Building

ment units in the country. Research and practice rooms, grouped about the radio station, will afford students exceptionally complete and unified facilities. The station itself, with its ante-room, studio, and station, will occupy the forward part of the left side. Behind this, there will be a research room, a branch corridor leading to the stairway and elevator, a telephone research room, quarters for high frequency testing, and finally a large radio laboratory. Located on the other side of the building, there will be a telephone and telegraph laboratory, corresponding in size to that for radio, and between the two and at the end of the main corridor will be an apparatus room. Forward on the right side, there are to be two offices opening off from an assistance room. Then the remainder of the space will be allotted to signal corps work, with subdivisions devoted to an apparatus room, a practice room, an office, and two research rooms.

Two seventy-five-foot towers, placed at the extreme ends of the roof, will support the radio aerial. And, in order to prevent useless speculation on the subject, it may be stated here that precautions will be taken to prevent the accessibility of the towers during class scraps.

A sub-basement will provide a large amount of general space, with only a small portion taken up by a machine room.

It is planned to devote the front section of the basement to mechanical equipment, electro-thermal practice, a classroom, two dark rooms, and a corridor running laterally the entire width, with entrance at the ends. In the connecting link, the right side will be divided into a students' toilet and a room for dielectric tests. On the left will be a janitor's closet, a laboratory, and two offices.

Sophomores have been kept in the basement for so many years that when the plans were laid out it was only natural to set aside a portion of this part in the new building for their laboratory. Professor Shepardson, however, intends to let the sophomores use part of the main laboratory. Rooms for measurements, meters, and spare parts take up the remainder of the right side. On the left will be a large storage battery room, a machine room, a shop, and three stock rooms.

Since its organization in 1889, the new building will be the first satisfactory solution of the department's housing problem. It at first occupied the east half of what is now the Men's union, which it vacated in 1899. Then it was scattered in seevral buildings, with the offices and library in the armory, the laboratory in which is now the forge shop, and classes wherever possible. In 1901, the present electrical building was erected at a cost of $19,766.50, exclusive of the chimney and basement, which were added later. The original plan was to put a front across at the east ends of the electrical and mechanical buildings, and in 1907 the legislature appropriated $250,000 for this purpose. During the same session, however, $450,000 was voted for extending the campus over the Great Northern tracks, and it was decided to wait and erect a building on the new ground. Accordingly, the $250,000 was used in the erection of the main engineering building, and the electrical department waited.

Agitation for the new building started again in earnest when on Dec. 12, 1910, the engineering faculty voted in favor of requesting its erection. After "almost" getting the bill through the legislature three times, it was included in the general University expansion plan, for which the legislature made a ten-year provision in 1919. In the spring of 1921, the regents made an allotment for visiting other electrical laboratories, and in December of the same year they voted $300,000 for the building itself.

Various considerations made it desirable to place the structure between the main engineering and chemistry buildings, but it was found that the cost on that site would amount to approximately $450,000, with only $300,000 available. The architects made their report to the board of regents in December, 1922, offering the alternatives of either a larger allotment or the use of a smaller site. Action by the Greater University Corporation released the space directly north of the main engineering building, and it was decided to place the electrical building here.

EDITORIALS

ARE YOU A GOOD CITIZEN?

The pre-election convocation was a failure. For many student offices only one candidate had filed and for some no one filed. The Engineering Council found it necessary to postpone the engineering elections for one month because of a total lack of interest in them at this time. These are facts it would behoove us to think about rather seriously.

Following out an eliminative type of reasoning in this matter, we have first the two alternatives that either we are wrong in trying to foist activities on the students, which demand the selection of officers; or these activities are good. Experience has shown beyond a doubt that activities do much to train students in a broader, more practical way and hence are of great value.

Granted the need for these offices, then we may either fill them by appointment or election. In this democratic age in which we live, election has always been preferred to appointment, by the people. We demand it as a constitutional right.

Hence, since these campus elections have the support, in theory, of the student body; the failure to excite interest in them is the fault either of the students themselves or of the present officials, whose duty it is to do their utmost to excite that interest. And if the latter be the case, it is the fault of the student body, again, for it is responsible for putting the present officials in office.

So you see, we arrive ultimately at the fundamental difficulty; the student at Minnesota either lacks the courage of his convictions, or he is indifferent, or he is simply lazy. The same person who waxes most eloquent if deprived of his right to vote is the one who uses that right the least. What type of citizen are we producing at Minnesota where the interest in the men we pick to govern us is so slight? A student is a poor citizen in the commonwealth of the University of Minnesota if he doesn't make every effort to ascertain who the best man for the job is, and then step to the polls on election day and cast his ballot wisely and sanely.—R. H. K.

BIRCH BURDETTE LONG SKETCHES TO MINNESOTA

The University is fortunate in obtaining the Twin City showing of this year's Birch Burdette Long Competition sketches. This competition annually calls forth the best work, in all media, of a multitude of sketchers both famous and obscure; and although it is required that an architectural subject be the chief item in the composition of each sketch, the freedom of treatment allowed is so broad that the showing becomes one of far more than mere professional interest. The prize-winning sketches, and many others of high rank, will be shown in the department during the early part of June.

SONG OF THE INCIPIENT INSANE

[Many engineers have asked us to publish the words to the song sung at the recent production of the Arabs' Club. The lyrics were written by Glanville Smith, a junior architect.]

Cosine, cosecant,
Calculate the upward slant,
Multiply by twenty-one,
Integrate it when you're done,
Deduct 6 per cent,
Locate points where rods are bent,
PV equals K,
So it was the other day.

Two-phase e. m. f.,
Lay that up to "Mendeljeff."
Millihenries, henries too,
Precipitate of milky hue,
Tesla's induction coil
Smells like lubricating oil,
Power factor equals K
W over kva.

Trig. is babies' play,
Borda's mouthpiece used to say,
Run a line from here to there
Triangulation everywhere,
Mean effective pressure
Gives a constant volume measure,
Medullary rays
Send the shakes in diff'rent ways.

Y equals 2PX
When the concrete first deflects,
Substitute and then divide,
Read on S, inverting slide,
Watch your dec'mal points,
Gusset-plates at rigid joints,
E equals I times R,
If you use a Leyden jar.

Cissoid of Diocles,
Cuts an arc of 12 degrees,
Laminate the armature,
Throw the switch and let 'er whirr,
Stuff like this is what
Makes the Engineer a nut;
Though this sounds like fun,
We'll tell the world we're glad it's done.

Tau Sigma Delta, honorary fraternity in Architecture, wishes to announce the pledging of Clarence Luedeman of class of '23 and Isadore Silverman and Laurence Tvedt of the class of '24.

COLLEGE NEWS

ARCHITECTS

APRIL DESIGN AWARDS

The usual disconcerting reversal of local awards was the rule in the New York judgment on the Beaux Arts problem, "A Bank in a Small Community." Eddie Holden received First Mention, Placed, in this later judgment (the local awards may be found in the April issue of the "Techno-log"), and A. Strom, R. F. Hennessey, Second Mentions. There is a certain poetic justice apparent in this two-judgment scheme; for to them who receive scant praise from the one jury, comes compensating commendation from the other.

CRESCENDO

After being utterly squelched by the inferential sarcasm a la the "Twin City Reporter" contained in the inch-and-a-half notice of the passing of The Blue God, contained in the "Alumni Weekly," the author picks from the wreckage but one recollection of the former glory. "The scenery and stage-novelties" were good, it seems. Thank Heaven! The laurels are sparse, but perhaps the Arabs can rest on them until next year; and then (if possible) filch a few more leaves from the jealous confines of "Alumni Weekly" criticism, for greater comfort.

But the scenery . . . *was* good. The Arabs admitted it all along; in fact they quite harped on it; and since the scenery was a child of the Architectural Department, it comes within our province to continue the pleasant strain.

"You can work on the stage Friday if you maintain strict quiet," explained Professor Scott to the Chief Arabian. "Mr. Fairclough will be giving organ-lessons, so there must be no shouting, hammering, sawing, or any of that."

"Absolutely not," affirmed the Chief Arabian, and laughed a throaty laugh.

Alas! poor Mr. Fairclough! All his sporting blood was required to combat impatience that Friday. Scene-painting was under way by 8:00 (it had been discontinued at 3:00 that same morning, and grievously interrupted by the Minnesota-Wisconsin Debate the night before), and by noon, carpentry in its most advanced forms was under way, and a class in Conversational Profanity had been organized.

It came about as a gradual crescendo, however. At 9:00 everybody said "Hush!!!" very loudly whenever Roy Norman cracked a particularly evil-smelling joke. At 10:00 the yellow calcimine suddenly gave out. This caused considerable commotion. Near 11:00 the paint-smeared crowd on the stage vituperated an equally paint-smeared, equally vituperative crowd in the flies because the latter group was not heavy enough to counterbalance the weight of a hundred and eighty-seven tons of gray velour curtains. At 1:00 Mr. Fairclough was heard to say something about tormentors. He frowned as altogether ignorant of stagecraft. It was just about this time that casters were put under the great idol. Sixteen husky-lunged Engineers in varying states of nerves and B. V. D.'s took it upon themselves to prove to Tony Johnson that he *could not* do it this way. Tony, of course, was doing it that very moment, but such items never silence a really good argument. At 2:00, Chuck Barnum was hammering and sawing away at the platform for the coronation scene. By this time there was a reception of and for curious visitors, in addition to the other din. Ami R. C. Jones dropped in in a blonde hat and noted with chagrin that his tickets read for that night's performance. "Are these things going to be ready by 8:15?" he inquired in astonishment. Izzy confidently replied "Yes," wiping the hair out of his eyes with one polychrome hand, thereby adding a strange green tinge to his already colorful countenance. And on played the organ, Bach and Mendelssohn, Bach and Mendelssohn, Bach and Mendelssohn, without end.

Buckets of calcimine were mixed (slightly) and applied to vast hungry expanses of barren white canvas. Splash! Splash! went blue into the burlap of the cave-scene. And Elving, with a fat grease-pencil, measured and measured and measured, and drew out dragons, band courses, corbels, and what not, from mysterious designs foisted upon him by the designers. 'Round and 'round ran Magoon in a pair of taupe rompers and a red pinafore, a bucket of Alabastine in each hand, a paintbrush between his teeth, and a determined glaze to his glittering eye. And Glanville swung in Maori ladybugs on a golden dado, and upset buckets of paint in even less fortunate localities. Carl Matthias, Art Ruddy, and Olaf in the property room, were violently accomplishing this and that—mostly that—and heaping anathemas on the head of Bach, who, alternating with Mendelssohn, there reverberated with more than ordinary sonority.

And above all, down scowled the dread idol of the Blue God of the Holy Bones of the Hundred and Thirteen Million Ancestors. Solid Saturday Evening Post, he, save for a tinge of the American Magazine as a sort of talisman to bring him to success despite his lowly birth.

And half-past eight arrives; the house-lights are out; the curtain slowly ascends to the mysterious music:

Sound O thou vina,
Sound concertina,
Croon, viol, croon.

There stands Itchy-Palm in his fantastic headdress silhouetted against the matchless blue of the cyclorama, beneath a dragon-twined arch. "Ah!" breathes the audience. Then Ah! for the great idol, and Ah! for the dusky cave—and Aw! for the "Alumni Weekly"; and the Blue God steps into history with majestic tread.

The scenery—*was good.*

CHEMISTS

PROF. L. W. JONES VISITS UNIVERSITY

Professor Jones, former Dean of the School of Chemistry and College of Engineering, and now head of the Department of Chemistry at Princeton University, stated in his address to the Minnesota Section of the American Chemical Society that "There is no comparison of the course in Chemical Engineering taught at Minnesota with that of any other university; it is far superior to any in equipment, facilities, and teaching personnel. With improvements and additions contemplated for courses of the other engineering schools, they too should take a standing similar to that which Chemistry now holds."

Professor Jones received his appointment to Minnesota in June 1918, under President Burton, and in 1919 he became Dean of the School of Chemistry and College of Engineering. Soon after his appointment took effect he was called to Washington, D. C., where he directed the researches of a great number of men in chemical warfare defense. In 1920 he was relieved of his duties here at Minnesota by the appointment of Dean O. M. Leland, which enabled him to devote all of his time to his work in Washington, D. C. Later he became Professor of Chemistry at Princeton, and has recently been advanced to the executive position as head of the department. At present he is touring the middle West and addressing principal sections of the American Chemical Society.

Those of us who have entered the School of Chemistry since Prof. L. W. Jones was Dean know little of his work here, but we can be greatly thankful for his having been here. For while here, Professor Jones not only helped design the Chemical Engineering Laboratory, which is reputed to be the best of any American college, but was instrumental in bringing Prof. C. A. Mann to head that department.

"CHEM" MIXER

At the Chemists' Club mixer, held just before St. Pat's day, election of officers took place, Bruce Weetman being elected president. During the card playing, which was the pièce de résistance of the evening, many new and brilliant sharks were brought out. Not the least features of the mixer were the many and omnivorous piano selections played by one of the members of the club. The evening was pleasantly passed, for smokes were smoked by the smokers, the smokeless ate candy, and all played cards.

AT IT AGAIN

The Sophomore Chemists proved themselves to be older both in experience and skill Thursday noon, April 19, when they defeated the Freshmen in a hot and elusive game of kittenball on the "Flats." This was the Freshmen's first appearance in the field of athletic competition since the extremely cruel and vicious (?) Class Scrap last fall. Now, as then, they had had little or no practice, and but for this fact the score of 7-2 might have been reversed.

The low score would appear to indicate good pitching and playing, but such was not the case. The game, as is liable to be at this time, was sprinkled here and there with numerous errors, and only our old friend "Lady Luck" kept the score down, as time and again scoring possibilities were passed up by lack of headwork. But time will show an improvement, so that when the teams meet again one can be assured of a well-played game. The success of the Sophomores was due to a very great extent to the work of their battery, Doran and Weetman. Although the Freshmen changed their battery several times, they made a good showing and helped keep the score down to one figure. After the first two innings the Freshmen played the Sophs on an even basis.

The teams were loyally backed up by some of the damsels from the School of Chemistry, who wandered down to the field, and for this able assistance they declare themselves most grateful.

Elaborating on entertainment and cutting down on speeches was the primary object of the committee that made arrangements for the Annual Chemists' banquet held in the ballroom of the Minnesota Union the night of April 25th. All preparations were made with the view of lending a chemical atmosphere (not of laboratory odors, though some of the profs. forgot to change into their "out of school" clothes) to the scene of festivities. The menu was cleverly written in terms that only a Chemist could translate. Following the banquet, Lyman Coult, toastmaster, called on Dean Leland, Miss Cohen and Alvin Fuhrman for short talks. Miss Cohen delighted her audience with an airy monologue.

After the speeches there were two hours of entertainment, in which the All-Chemist Band, a surprise orchestra, made its debut attired in wigs and large spectacles. Two singers helped out with the music, while a professional dancer kept the eyes of the audience busy. Take-offs on the faculty were rendered by students. Place cards were set for 100 guests.

SCANDAL! SCANDAL!

Turmoil and chaos enough to satisfy the most rabid "Red" reigns supreme in the fragrant atmosphere of the "Chem" building. To the rank outsider all is peaceful and quiet—but, alas! all is not spaghetti that is stringy! We, on the inside of matters, have noticed that the atmosphere is getting warmer, more peculiar every day. Perhaps Miss Cohen was engaged in a new experiment to raise the marks of her students? Perhaps the Juniors were engaged in Spring housecleaning with a new batch of their valeriate soap? Ah! No! But "Truth will out" (or is it murder?—anyway I mean truth). The trouble was traced to the general offices of the Sophomore class, and, worse still, they admitted it. Perhaps these enchanting, enthralling, spellbinding, captivating, not to mention scintillating, members of the other sex are so rare in the aforementioned school that it couldn't be helped; anyway, what we started out to say was, that Miss Ruth Stier, the lonely (?) maiden of the Sophomore class, was honored at a recent meeting of that class by being elected its president. Long may she reign!

A Tau Beta Pi honor roll is to be erected in the Colorado Engineering Library and will be in the form of a bronze tablet with the name engraved of the sophomore in the college who has maintained the highest scholastic average.—*Colorado Engineer*

ELECTRICALS

BUS BAR INSULATORS ARE TESTED

By Donald Swift

PROFESSOR L. W. SPRINGER of the Electrical Department conducted some very interesting tests during the latter part of March. The Byllesby Engineering Corporation was considering bus bar support insulators made by three different companies and was desirous of finding out which insulator was the best.

These bus bar support insulators are cylindrical in shape, about 6⅝ inches high and 6 inches in diameter, with steel holding plates attached to the top and bottom. They are used between bus bars and the bus bar supports to keep the bars in line and to insulate them from the supports. As ordinarily set up, the bus bars are parallel and quite close together and when carrying current are strongly attracted or repelled by each other due to the magnetic field set up about each.

Not only must the insulators withstand the high voltage, but they must keep the bus bars in alignment as well. In calculating the stresses which the bars are subject to, the electrical engineer's old friend $F = Bil$ is of prime importance. Although this equation becomes more complicated in actual calculation, the fundamental equation, which everyone knows, is at the bottom of the whole problem. Each bar has about it a field $B = 21/P$ gauss in strength. From these equations, it is plain that a short circuit of a generator, where currents up to 25,000 amperes may flow, will cause large forces to act which tend to push the bus bars away from each other.

The situation is made worse by the fact that in alternating current systems this force varies from zero to a maximum value 120 times per minute. If the bus bars happen to be a little loose on their supports they will vibrate and will act as though they were hammers striking the insulators with heavy blows. In the equation $Fs = ½ Mv^2$ we can see the reason for the magnitude of these hammer blows. Fs varies as v^2 and if the bars are in mechanical resonance with the force which acts on them 120 times a minute, a rapid vibration will be set up. This results in the quantity v^2 becoming very large and it is plain that with a small distance of vibration, s, the force F will become dangerously great.

Good insulators must therefore, be able to withstand safely these hammer blows besides insulating the bus bars from their supports. It was to determine which company's insulators showed the greatest physical strength as well as the ability to withstand high voltages successfully, that Professor Springer made his tests.

The first test was a flashover test. The insulators were dusted off and suspended in air. Voltage was then applied across the ends until an arc was formed around the insulator which was approximately 6⅝ inches high. This test was merely to insure that none of the insulators were cracked. The first real electrical test was another flashover test. Two insulators of each kind were carefully cleaned with alcohol. Voltage was applied across them and at 75,000 to 100,000 volts an arc was formed around the insulator through the air. The test was rather spectacular as the large arc looked almost like lightning.

Two more insulators of each make were used in the puncture test. They were immersed in an oil bath to prevent an arc through the air and provision made so the arc could not flash around the outside of the oil bath. Five of the insulators arced through the oil at voltages ranging from 175,000 to 230,000 volts while the sixth was punctured with 140,000 volts. The third part of the electrical tests consisted of splitting off the insulator porcelain so that they behaved as though they were cracked. It took almost 40,000 volts to arc between the end castings of the insulators.

Tests of physical properties were next made in the Experimental Building where the insulators were subjected to compression tension and side pull or cantilever tests. In the cantilever tests, which most closely approximated the conditions encountered in actual use, the insulators were attached to short sections of bus bars on one end and rigidly attached to a solid base on the other end and subjected to a side pull from the sections of bus bar. This is practically what occurs when two bus bars are carrying heavy currents side by side. Tensions of about 5,000 pounds and compressions of about 40,000 pounds were borne by the insulators before they cracked or broke.

This was a typical engineering problem in that at the bottom it was made up of the well known fundamental principles. That is engineering, the application of our knowledge of the fundamentals to the special problems which arise.

CIVILS

BANDIT DIES OF WOUNDS AFTER ATTEMPTING HOLDUP

> St. Louis, Mo., April 12.—Loyd Mitchell died this afternoon from a bullet wound received yesterday when he and Emil Meyers were surprised by city detectives as they were holding up a card party in a private home. Meyers was killed instantly in the exchange of shots. None of the officers were wounded.

This article in a local paper was the first word of Mr. Mitchell's death received by his many friends here. Now we know why Mike has been wearing that disguise.

BROTHERS IN TROUBLE

When Tau Bets go stepping they sometimes step too excessively—on the gas. Paul Swanson and "Benny" Leonard were early morning callers at the courthouse a short time ago.

EXPERIENCE

How many engineering students realize what splendid opportunities an engineer—and especially a civil—has for gaining outside and practical engineering knowledge right here on the campus at this time?

Construction work of many types, ranging from ditch digging to bridge building, is being done, and an observer can gain knowledge which may be invaluable later. WE students must keep our eyes open, and as as suggestion, a form of diary which contains occurrences of an engineering nature might be kept up and would undoubtedly be very useful.

MECHANICALS

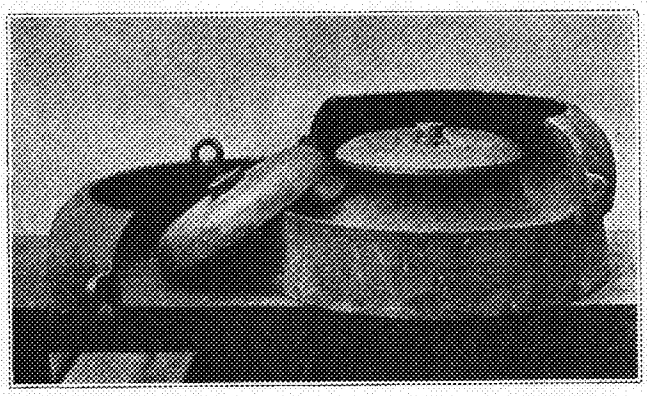
MINNESOTA PROFESSOR DEVELOPS NEW TYPE OF OIL BURNER

By L. P. Grobel

PROFESSOR SHIPLEY of the Mechanical Department installed a commercial oil burner in his home last fall. The system did not work well, caused considerable trouble, and he also thought the burner of a dangerous type when anything went wrong with it. Because he had contracted for the winter's supply of oil, he decided to design a burner himself.

The original design was a guess, but worked so well Professor Shipley has made no change in it. The vaporizing feature of the atomizing plate was an accident in the construction. He is not anxious to develop the burner for commercial purposes, but some of his friends who have seen it in operation are urging him to take out patents.

The burner is made of cast iron throughout, is assembled from four castings, and weighs thirty-six



The Shipley Oil Burner

pounds complete. As it requires very little machine work, and is made of cast iron, the burner is not expensive to manufacture.

Installation is made with no change in the construction of the furnace. It is put through the fire-door and rests upon the center of the grates. The oil and overflow connections are made through the bottom of the grates and extend through the lower draft opening. The remaining grate area is covered with ashes, sand, or sheet metal, so that all air passes up the base of the burner.

There is one precaution in installation. The machined surface of the atomizing plate must be level so that the oil will flow out and burn evenly around the burner.

The feed is regulated in the oil line by a needle valve, which is automatically controlled by a syphon regulator.

The usual drafts and dampers control the air supply. The overflow is arranged to drip into a cup, which by its weight operates a positive-acting safety shut-off valve. The burner is so constructed that there is no auxiliary equipment to care for and get out of order. It is one of the few successfully operated burners using natural draft and gravity feed.

The results of operation in Professor Shipley's home this year, and of tests made in the Experimental Department, show that the burner works satisfactorily at all loads and is readily regulated and adjusted. The average efficiency compares favorably with that of the more expensive and elaborate installations. Some of the features could be studied and perhaps improved upon to get even greater efficiency.

EXPERIMENTAL WORK BY THE SENIOR MECHANICALS

The following problems are being worked upon this quarter by the Senior Mechanicals:

"Burning Oil Under House Heating Boilers," by L. L. Amidon, R. H. Kuhlman, B. Bros (and C. F. Olmstead on his thesis).

"Percentage of Heat Lost in the Exhaust Gases of an Internal Combustion Engine," by K. W. Keiser and H. Staehle.

"Effect of Humidity in the Gasoline Mixtures for Internal Combustion Engines," by G. Bachman and P. G. Swanson.

"Efficiency and Operating Characteristics of a Foos Single Cylinder Engine When Burning Alcohol," by O. G. Parkin, O. W. Schey, E. Eige and G. Larson.

"Tests on the Two Cycle, Single Cylinder Marine Engine that Is Being Manufactured in the U. of M. Machine Shop," by S. S. Hibbard and E. Lindelien.

"Hydraulic Ram Characteristics," by C. R. Marshall and G. C. Bergsland.

"Lignite Coal Briquetting and Burning Characteristics," by R. E. Cross and P. U. Sartell.

"Governing of Triple-Expansion Marine Engine," by A. Sear and A. Gilstad.

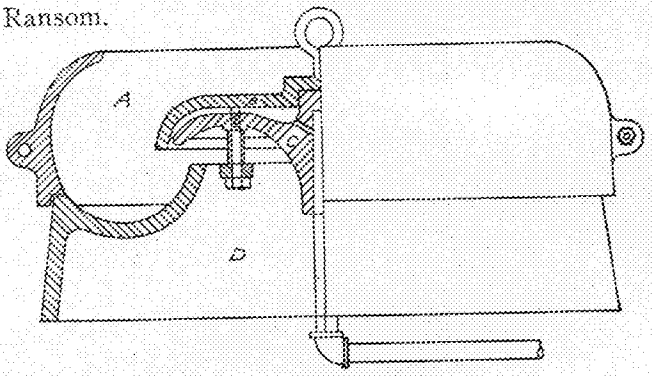
"Tests on Vacuum Pumps for Condensers," by H. E. Peckham and E. V. Brossard.

"Economizers and Condensers at the Minneapolis Street Railway Power Plant," by F. E. Copeland and D. T. Waby.

"Oil Characteristics and Tests on a New Viscometer," by S. H. Acker and R. C. Ascher.

"Calibration of Boiler Feed Metering Devices at the U. of M. Heating Plant," by R. E. Cross, H. D. Messer and H. O. Halden.

"Air Measurements in Fan Tests," by R. W. Ransom.



SHIPLEY OIL BURNER.
A Shield. B Deflecting Plate.
D Base. C Atomizing Plate.

SCIENTIFIC MANAGEMENT

Professor Flather, head of the Department of Mechanical Engineering, has been asked recently to recommend for positions men well trained in "Scientific Management." These positions carried salaries of $400, $200, $175, and $150 per month, respectively. One of last year's graduates in Mechanical Engineering was recently placed in a $200 position of this kind.

In addition to having a sound knowledge of the fundamentals of "Scientific Management," applicants for such positions must possess initiative, earnestness, and executive ability.

SPORTS

VARSITY BASEBALL

The Gophers got away to a poor start, losing games to Hamline and St. Olaf and finally coming through with a win over Macalester. Coach Watrous gave all the men on his squad a chance to show what they could do in these preliminary games and in this way got a good line on his regular line-up. Les Friedl and H. Hartfield are the cream of the pitching staff and are slated to alternate in the hurling in the conference games. Christgau does the receiving behind the bat when Friedl is on the mound and W. Hartfield will catch when his brother pitches. The infield consists of MacMurphy, 1st base; Moschovitch, 2nd base; Capt. Myrum, 3rd base; and Foote, shortstop. This combination has been working pretty well but there are still weak spots at short and first base. The outfield is a source of joy to Gopher followers as they have all played errorless ball in both conference games. Outfielders are Rumble, K. Bros, Gambil and Radke.

The first conference game was with Northwestern. The Gophers were slow in getting started allowing the Purple a big lead at the start. The game seemed hopelessly lost but in the last half of the ninth, the Gophers put on their slugging clothes and drove in five runs, Pitcher Hartfield accounting for the winning run with a smashing single over 3rd base.

Iowa was Minnesota's second conference foe and came here fresh from a victory over Illinois, for five years conference champions. Iowa gained an early lead, scoring three runs in the second inning; but from then on to the end of the 14-inning game they were held scoreless. Minnesota scored the tying run in the eighth inning and there was no further scoring until the Gophers came to bat in the fourteenth when Les Friedl, who had pitched wonderful ball during the whole game, knocked a home run with two men on bases, clinching the game for Minnesota.

VARSITY TRACK

Minnesota starts her outdoor track schedule with a dual meet against Wisconsin and from then on has a meet every week-end until the conference meet. The Gophers are strong in the hurdles and field events but will have stiff competition in the conference this year. Towler is a sure point winner in the hurdle events, winning the 120-yard high hurdles at the Drake relays against the pick of conference hurdlers. The Wisconsin meet last year was very close, Minnesota finally winning by taking a second in the broad jump, which was the last event of the day. The team is determined to repeat again this year.

The State Interscholastic Meet will be held at Northrop Field, May 19, and Coach Metcalf is expecting one of the largest meets that has ever been

SPRING FOOTBALL

Coach Spaulding has one of the largest squads of football aspirants in the history of spring football at his beck and call at the present time. Eighty-eight men are on the roll of hopefuls compiled by Manager Greene. Due to conflicts between football and classes, part of the boys report on alternate nights, thus giving Coach Spaulding a less unwieldy bunch to handle, and making the spring season less strenuous. A large squad for spring practice augurs well for next fall, and also demonstrated the general liking that the men have for "Bill," more power to him!

SWIMMERS HAVE TRIP TO ROCHESTER

At the invitation of the Rochester School Board, two of the Engineers' swimming luminaries made a trip to that town to assist in the festivities in connection with the opening of the new high school tank. Captain Lanpher, of this year's Gopher team and last year holder of the national record for the 440, and Harold Bird, conference champion in the fancy dives, were the men selected by Thorpe to demonstrate the way things are done at Minnesota. The boys did their stuff for the edification of the Rochesterites, and remained in town the following day in order to give the school boys some pointers in the water art, thus getting in some good missionary work for Minnesota.

INTRAMURAL SWIMMING

Saturday, May 12, has been set by Coach Thorpe as the date for the annual intramural swim meet. The Engineers have an excellent chance to clean up in this event, judging from the large number of engineering aspirants to the varsity and freshman teams of the past season.

Thorpe boasts that his Engineers are always there when required. Always eligible. He says they have so much work to do that they don't get lazy and hence gather in a flock of flunks.

The Iowa baseball game was the occasion for a "coming out" party for the the new "M" sweaters won since the football season. White seems to be the rage this year. Oscar was kept busy doling out the sweaters all during the day.

Oscar, our custodian of athletic equipment, has taken to himself royal privileges. All his cards, letters, and orders are simply signed "Oscar," he doesn't bother with the rest of his name.

INTRAMURAL BASEBALL

Plans are being made for the playing of an inter-college schedule. There will be no regular inter-class baseball, due to the lack of diamonds; but the Engineers will play off an interclass kittenball

ALUMNI

Park Tarbell in a letter to Mr. Zelner gives an interesting account of his experiences in teaching at the North Dakota Agricultural College at Fargo, N. D.

"I started in at the City Engineer's office, but was there only two weeks when the Engineer loaned me to the College to help them out, as they were very short on instructors. At the end of the quarter they made arrangements to keep me for the rest of the year, using the students in surveying to do some city work.

"Since the middle of January, I have had to teach 'Reinforced Concrete,' 'Sewage,' 'Water Purification,' 'Highways,' 'Drawing,' and 'Surveying.'

"I have a tough proposition to work out, a resurvey of about one hundred fifty acres, built up, curved streets, woods, river, and everything else that goes to make a survey complicated. In addition, the plats do not agreed in angles, distances or anything else. All that I can see that can be done is a physical survey, and a replatting. We made a survey out there once, and it took twelve men two days to get enough dope to put the stakes in, and the survey didn't agree with anything.

"I have taught my survey stuff as near 'a la Zelner' as I could. Wish I had you (Mr. Zelner) here to give them the 'color' though. There is no doubt that actual experience in winning your meal ticket on a regular job gives you a background for teaching the subject."

Ellsworth Johnson, C. E. '22, is helping chase locations in the Big Horn mountains near Sheridan, Wyoming. His work there is with the Wyoming North and South Railroad, which is putting in a 330 mile line.

Clarence Rader, C. E. '17, fills the position of Petroleum Engineer for the Midwest Refining Co., of Casper, Wyoming. He writes concerning his work: "The profession of petroleum engineering is of quite recent date. One might say that it includes that of geology and of efficiency engineering. Because of the scarcity of trained men in the profession, many of the oil companies are taking young graduates and are training them in every phase of the work, from the pick and shovel on, thereby giving them the first hand information required."

Alvin Anderson, M. E. '18, was last year made Chief Engineer for the Mahr Mfg. Co., of Minneapolis, having been Assistant Engineer since 1919.

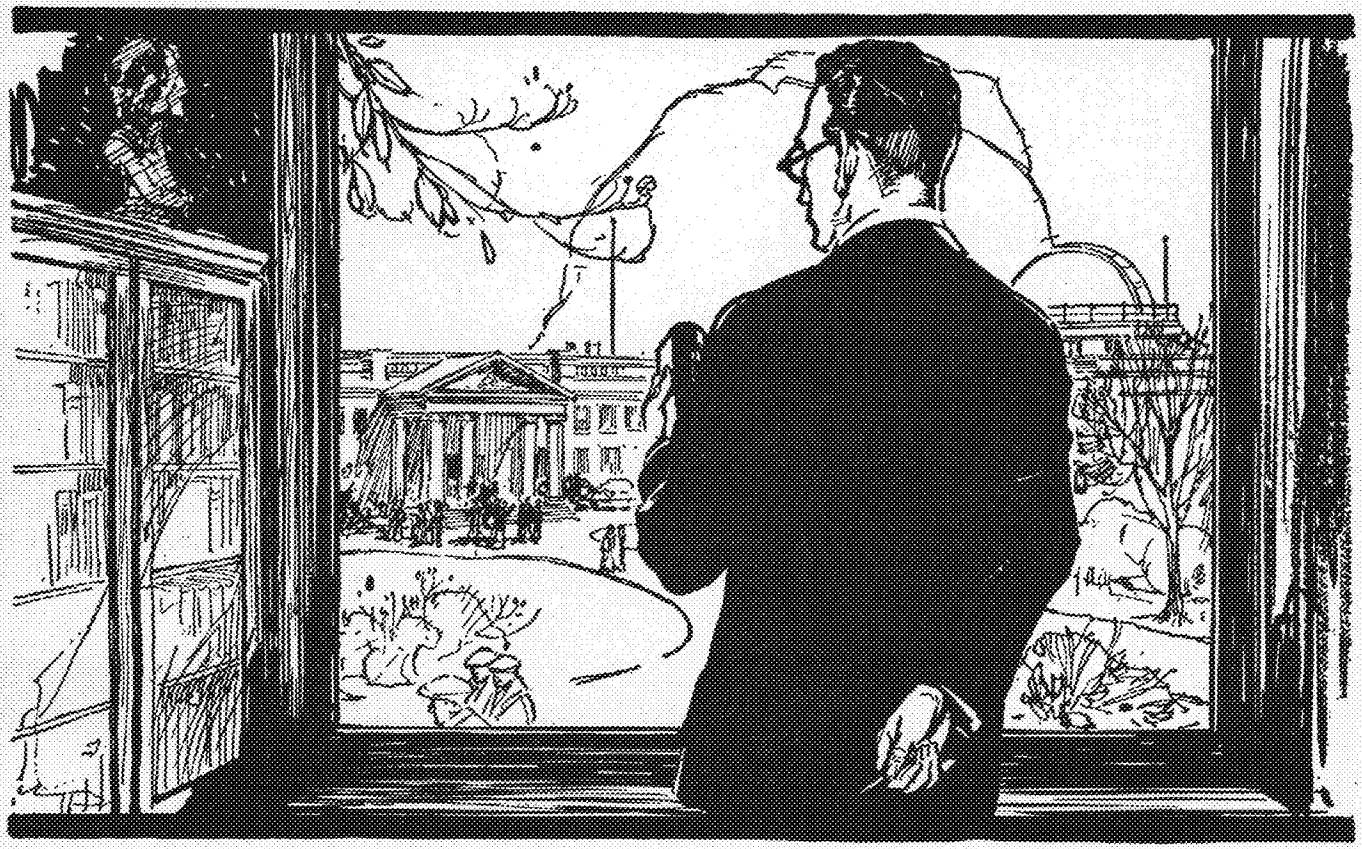
Millard Johnson, who was formerly an engineering student at Minnesota, has been working as instrument man of a party surveying for the Spokane Valley Land and Water Co., but has recently been promoted to the position of flume inspector. He expects to return to Minnesota next fall to complete his course.

Richard Peterson, E. E. '20, is with the General Electric Co. located at St. Paul.

Norman Kingsley, E. E. '20, has left for New York City to attend the Interference School of the American Tel. and Tel. Co.

Ray Lockwood, E. E. '20, has left the American Tel. and Tel. Co., at Chicago, to return to Minneapolis.

Geo. Brookes Deane, Arch. '19, has been since 1920 an architectural draftsman for Croft and Boer-



Teaching Engineering—a Real Man's Work

"Why are you satisfied to spend your days here when you might be doing bigger and more remunerative work with us?" The speaker was the Vice President of a big corporation, and he was addressing a great chemist.

The man to whom he spoke looked from his study window out over a well-loved campus for several moments before he replied. Finally his answer came, "I guess it's because I am more interested in helping to make *men* than I would be in just making *things*."

This thing of building men is one of the most fascinating vocations known. The pleasure that grows out of watching men develop, out of seeing them make effective use of the fundamentals that have been so carefully given them to use—it is doubtful if there can be any pleasure much deeper or more satisfying.

The teacher honors himself in the usefulness of his students. And the teacher of engineering, especially. His laboratory and his materials are in the minds of men. He shows them the right and constructive use of the senses and the memory in securing and storing information. He trains the judgment and the will to analyze and to decide. Little by little he develops the will to do, the ability to turn decision into accomplishment, the quality that always marks the successful engineer, who is a man who gets things done.

Westinghouse, and every engineering business, must acknowledge a deep obligation to those teachers whose training and interest have been an inspiration and a sure foundation for the individual successes that are constantly being recorded. And nothing that men or events may do can deprive the teacher of his rightful share of such triumphs!

Westinghouse

ACHIEVEMENT & OPPORTUNITY

WESTINGHOUSE ELECTRIC

NEW AIRSHIP GAS

Dr. Edward Curran, of the International Transportation and Manufacturing Company of Los Angeles, recently demonstrated a new gas, currenium, having a weight of six and two-tenths pounds per thousand cubic feet at a pressure of thirty inches of mercury and a temperature of forty degrees fahrenheit. Its lifting power is practically equal to that of hydrogen and it has the advantage of being incombustible, except when very greatly diluted with oxygen. Currenium can be produced electrolytically at a cost of one hundred dollars per thousand cubic feet. The process was developed in 1918, but the inventor was not satisfied with the purity obtained by the process as first developed and continued his research work to date. —*Tech. Journal.*

In memory of Robert Stewart Brooks, a loyal son of Princeton, and through the kindness of a friend of the University a fund has been given to enable the younger professors of the School of Engineering to visit engineering enterprises and make a closer contact between engineering practice and teaching and bring back to their classes the benefits of this contact. It is hoped that this may prove of mutual aid to the engineers in practice and the teachers. The grants may be sufficient for full support during a leave of absence or may be supplemental to the funds of the recipient on leave. The fellowship is to be known as The Robert Stewart Brooks Fellowship in Princeton School of Engineering. Brooks had plans for his future support of his alma mater which will not be realized on account of his death. The donor, however, wishes to perpetuate the name of one who had planned great things.

The fund is available for any department of the School of Engineering and it is a pleasure to announce that the first to receive a supplement grant is Professor G. E. Beggs.

The highest voltage testing transformer equipment that has ever been sold is being built by the Westinghouse Electric & Manufacturing Co. for installation in the new high voltage testing laboratory of the California Institute of Technology at Pasadena, Cal.

CHEMISTS' CLUB ROOM

Some time in the near future the Chemists' Club is to have a club room, if the authorities heed their pleas. For some time the students of the School of Chemistry have been talking over the idea of a room where groups of them could gather and talk over problems in Mathematics or Chemistry, or discuss the possibility of a class dance, or even yet, just talk. At present there is no such place in our school, and it was with the need of such a room and the presence of a room which would fill this need that the Student Council of the School of Chemistry took the matter in hand. This room is used occasionally for registration and faculty meetings, which leaves it vacant and unused for the majority of the school year. It is the students' desire that this room be set aside as a place where the students may hold class meetings, hold seminars before quizzes, or just gather and talk. Whether or not the students have this room is in the students' hands. The Student Council and the Chemistry Club will do all in their power.

ELECTRIC CABLES

(Continued from page 7)

tion is afforded by use of copper strip fuses, except on the 500-volt direct current power lines and in the customers' service cabinets.

In an underground system trouble of one kind or another is likely to occur at any time without warning. In order to operate a system with a minimum of interruption to service, all breakdowns must be located and repaired with the least possible delay. Trouble occurring in a cable is usually due to a breakdown of its insulation or to the melting of a conductor when forced to carry an overload by accident or in case of emergency. Breakdown of insulation is due principally to overheating, old age, mechanical injury, or entrance of water through a hole in lead sheath. If the breakdown occurs in a manhole, it is repaired by splicing in a short piece of new cable. If it occurs between manholes, the whole section of cable between the manholes must be replaced by a new section. This replacement makes it necessary to get a cable crew busy pulling in a new section, and, if there are no spare ducts, the old cable must be pulled out to make room for the new one. On 13,200-volt tie-line cables, a test must be made before the last splice is closed in order to have the same connections as existed in the old cable. This test is made with low voltage test lamps on current supplied by one of the stations which the cable connects. To avoid the possibility of damage to oil switches and other station equipment when the cable goes into service, this test must be carefully made to insure proper connections.

Occasionally a pothead blows up, due either to a "flashover" through broken or cracked insulators, or to being hit by lightning, these breakdowns usually occurring in stormy weather. Obviously the only repair is a partial or complete replacement of the pothead.

Trouble with transformer banks may be either internal trouble or fuse cutout trouble. The transformer may be burned out, short-circuited, or grounded; and, if so, must be replaced by one that is O. K. If the fuse cutout has blown, the fuse must be replaced. Occasionally the whole cutout and case is blown up and must be replaced.

Of course, these remedies cannot be applied until the location of the trouble is determined. The most difficult kind of trouble to locate is a cable breakdown. There are several methods of attack. The first and commonest one is that of entering manholes through which the cable is routed and looking for burnt-off or injured cables. Sometimes the trouble is located when examining manholes by the peculiar odor which a burnout gives off. If this method fails in the case of a 13,200-volt tie-line, current is supplied to the cable at pressures of 2,300, 6,600, or 13,200 volts through current limiting reactances. The voltage used is one which will jump whatever gap there is in the breakdown and flow in a circuit through the breakdown and the cable between the breakdown and the station. An exploring coil with a telephone headset connected to it is used, and when held close to a cable carrying any current will cause a 60-cycle hum in the phones due to the current induced in the exploring coil. Starting near the station, a test is made on the cable in each manhole along its route until a manhole is reached

where no current is indicated. The fault will be between this manhole and the one in which the previous test was made. The test current jumping through the breakdown will often make a noise which can be heard in the nearest manhole, and sometimes even in the street near the open manhole.

Other methods are used according to the type of cable system in trouble, and are principally processes of elimination in which the location of the fault is deduced partly from the conditions of the particular case of trouble and partly from the results of tests made at suitable places.

The series of duct-line explosions and burnouts which occurred under downtown Nicollet Avenue on the night of Saturday, July 30, 1921, is an example of a serious emergency. A cut is shown of a snapshot taken about one week after the Nicollet Avenue duct-line explosions. The picture shows the inside of a manhole at Sixth Street and Nicollet Avenue after the top had been removed and board sheeting driven. Burned-off cables can be seen protruding from two four-way McRoy tile ducts, and the remains of a feeder junction box is in the lower right-hand side of the picture. Below the junction box is its cast-iron cover, through which a large hole has been burned. The floor of the manhole was covered with a thick layer of solidified spatterings of melted copper and lead from the short-circuited cables. Though many important cables were destroyed between Fifth and Seventh streets, service was restored to all customers at an early hour the following morning. On Monday morning a large construction crew began to tear out the ruined cables and duct-line and to build a thirty-six-tube McRoy tile duct-line to replace the ruined one.

FINANCING A COLLEGE EDUCATION

Is a college course worth the financial sacrifice it entails? In answer to this is the inspiration of the splendid articles in the engineering press and the eager desire to become an engineer which decided Lewis H. Kessler, of the factulty of the University of Wisconsin, that it was worth while. His analysis of the problem makes it evident that as far as the saving of money is concerned at the end of his four years' course, the man who goes to college stands about the same as the man who goes to work.

Another student after being released from the Navy, in 1918, had $100 and one worn suit to start in college. His carefully kept account for 46 months showed that it cost him $3,791.39 and at the end of the Summer Survey Camp an inventory of his property amount to about $1,043. He had incurred only one debt, of $500. The student must form the habit of saving and make his earnings go as far as possible, while the man out working does not feel that he must save so carefully and so another benefit derived is the valuable habit of saving which should be considered in the value of an education.

Further this student enjoyed all the privileges of a social fraternity, participated in athletics as much as any engineer has time to and eventually found a life partner, all of these being normal to the average engineering student.

Comparing the associations, business connections and practical experience of the working man to the forming of habits, making of associations and cultivation of friendships of the college student, it seems to prove that a sound investment has been made and a valuable asset has been obtained.

—*Wisconsin Engineer.*

TECHNICALITIES

MUSICAL HITS AND WALKS

"East Is West."—By Ben Turpin.
"The Birthday Cake May Be Heavy But the Candles Make It Lighter."—By Heck.

"So you've sold out three dozen pairs of hoisery since morning," cried the lady customer. "I don't see where they all go to."
"Neither do I," blushed the male clerk.

Cholly—"The dentist told me that I had a large cavity that needed filling."
Ethel—"Did he recommend any special course of study?"

Stalling is the secret of successful lovemaking, says Rudolph Valentino, the Sheik. Never kiss a girl the first time you see her; get her anxious.

Prof. Priester was heard to remark, "I had to correct these papers immediately because they were so rotten that they wouldn't keep.

On a mule we find two legs behind,
And two we find before;
But we stand behind before we find
What the two behind be for.

Judge—"You are charged with perpetual drunkness. What is your defence?"
Miscreant—"Perpetual thirst."
—Puppet.

Love lives on hot lips, warm hearts, and calves' brains.

Mary had an eloquent skunk,
Its verse was good, but its air was punk.

A BITE IN TIME

They sat on the porch at midnight,
And their lips were tightly pressed;
The old man gave the signal—
And the bulldog did the rest.

There was a young man named Paul,
Who went to a fraternity ball;
But during the dance,
He fractured his pants,
And had to go home in a shawl.

Hell hath no fury like a woman's corn.

The girl who's not so good looking, but can dance like the deuce, is like an Elgin movement in an Ingersoll case.

A PRETTY LITTLE TALE

This is the story of Johnny McGuire,
Who ran through town with his trousers on fire.
He went to the doctor's and fainted with fright,
When the doctor told him that his end was in sight.

Judge—"Ten days or ten dollars—take your choice."
Prisoner—"I'll take the money, your honor."
—The Councilor.

Mother—"Johnny, run over and find out how old Mrs. Jones is today."
Johnny (upon returning)—"Mrs. Jones says that it is none of your business how old she is."

Beggar—"Kind sir, will you give me a dime for a bed?"
'26 (cautiously)—"Let's see the bed first."
—Gargoyle.

Diner (trying to cut his steak)—"Say waiter, how was this steak cooked?"
Waiter—"Smothered in onions, sir."
Diner—"Well, it died hard."
—Yale Record.

Stude—"See this chalk on my shoulder?"
Room-mate—"Yeh."
Stude—"Well, that ain't chalk."
—Jester.

Wife (finding husband drunk)—"This is the last straw."
Husband—"Thass awright, m'dear; I never use 'em. Jesh give me the bottle."
—Chaparral.

The meanest man in the world is the one who broadcasts the popping of champagne corks from Havana.

A good toast to the co-eds is "To the ladies, God dress them."

Jack—"Didn't you see me down town yesterday? I saw you twice."
Jacqueline—"I never notice people in that condition."
—Jester.

Blessings on the, little dame,
Barebacked girl with knees the same,
With thy turned down silken hose,
And thy thin, transparent, clothes
With thy red lips reddened more,
Smeared with lipstick from the store,
With thy make-up on thy face,
And thy bobbed hair's jaunted grace,
From my heart, I give thee joy,
Glad that I was born a boy.
—Green Gander.

BLANK VERSE.

A boy fell from a cherry tree,
He lit upon his head;
Sad as it may seem he was profane
"——! ——! ——! ——!" he said.

HORACE: "That girl has a fine figure."
ALGERNON: "Yes, about $1,000-

ROUGHNECK'S LAMENT.

For why did I take engineering?
Why ain't I an S. O. and L.?
There aren't any co-eds in our school,
This life, Oh, it surely is H—l!

They work us from dawn until midnight,
I never go out any more.
One thing that I love is our army,
What was Sherman's remark about war?

Then that glorious sport river-banking
To me, is a forgotten joy;
Another bird takes my girl a-strolling,
D—mn him! the dear little boy.

I own—not even a flivver,
In fact, I'm perpetually broke,
So the girls act—oh, so exclusive;
Gosh—Honest it ain't any joke.

Some day I'll be through this here college;
I'll own the world—maybe even a wife;
But then I'll be old and decrepit;
Oh DAMN, it's a hell of a life.
—C. E., '24.

STEEL MANUFACTURE

(Continued from page 11)

poured into the ingot moulds, and these ingots of pure iron are allowed to cool, there is a tendency for the ingot to form what is known as a pipe. This is a thin column of air down through the center of the ingot, which is produced because the iron cooling at the outside of the ingot has a tendency to contract from the center. If an ingot of this type is run into a sheet bar and the sheet bar into a sheet, a laminated sheet results, which of course is practically worthless for commercial use. This difficulty is overcome by cropping the ingot before it passes into the blooming mill, until the pipe has been entirely cut away and a solid mass of iron has been reached. Again, there is a tendency at times for an ingot to become porous because of the occluded gases. Those mills manufacturing pure iron split ingots at frequent intervals to observe whether this condition exists, and if it does exist the heat is discarded, or is rolled into an inferior product.

Another point in the manufacture at which great care must be exercised is in the soaking pit, where the ingots are re-heated prior to the time of rolling. There are certain critical temperatures which are indicated by the color of the ingot, and which must be watched very carefully to insure against ruining the product.

Another fact of vital importance in the manufacture of modern pure iron is the inspection of the sheet bars against mill scale, laminations, scabs, etc. Annealing also must be watched carefully to insure proper molecular structure. Iron in passing through the process of manufacture is subjected to a very severe treatment. It is heated and re-heated, rolled again and again, and as a result the molecular structure is disturbed. To restore a normal condition the manufacturers of pure iron box-anneal the sheets. They are piled one upon another upon an iron plate, and an iron box is placed upon them, and they are put into the annealing furnace and subjected to a temperature just below the melting point for a long period of time to insure a perfect structure in the body of the metal.

It will be seen from the foregoing that as much attention is paid to the physical structure of the metal as to its purity, because studies of corrosion have indicated very clearly that physical structure has almost as much to do with the resistance to corrosion as the purity of the metal itself. A homogeneous, dense metal does not fall an easy prey to corrosive action, and when this condition is assured and purity of metal obtained, maximum resistance to corrosion results.

The results obtained from this modern commercial iron have already been sufficient to warrant the expenditure of the time, energy and money in the perfection of the product. Structures made from this commercially pure iron have already shown a service life of fifteen years, and recent investigations of these old installations have indicated conclusively that they have but begun their period of service, and that they may be expected to show a service record equal to that shown by some of the old iron articles of ancient and semi-modern manufacture.

M. Wichman, E. E. '21, is in the Transmission Engineering Department of the Northwestern Bell Telephone Co.

"DAVY EXPERIMENTING WITH GARNETT IN THE ROYAL SOCIETY"

The First Electrochemist

NITROUS oxide, according to the science of a century ago, was "the principle of contagion when respired by animals in the minutest quantities." Mere say-so.

Imaginative yet skeptical Humphrey Davy, who believed in experiment rather than in opinion, "respired" it and lived.

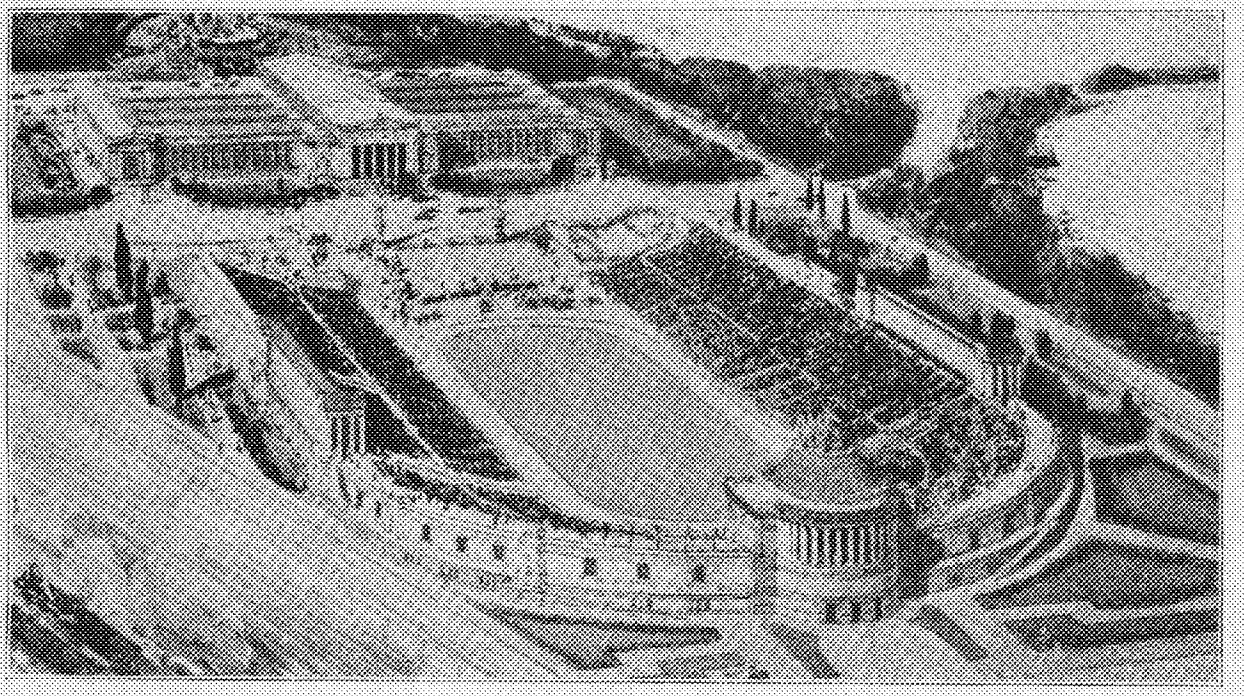
It was this restless desire to test beliefs that made him one of the founders of modern science. Electricity was a new force a century ago. Davy used it to decompose potash, soda, and lime into potassium, sodium, and calcium, thus laying the foundations of electrochemistry. With a battery of two thousand plates he produced the first electric arc—harbinger of modern electric illumination and of the electric furnace.

Czar Alexander I and Napoleon met on a raft to sign the Treaty of Tilsit while Davy was revealing the effects of electricity on matter. "What is Europe?" said Alexander. "*We* are Europe."

The treaty was at that time an important political event, framed by two selfish monarchs for the sole purpose of furthering their personal interests. Contrast with it the unselfish efforts of Sir Humphrey Davy. His brilliant work has resulted in scores of practical applications of electrolysis in industry and a wealth of chemical knowledge that benefit not himself but the entire world.

In the Research Laboratories of the General Electric Company, for instance, much has been done to improve the electric furnace (a development of Davy's arc) and new compounds have been electrochemically produced, which make it easier to cast high-conductivity copper, to manufacture special tool steels, and to produce carbides for better arc lamps.

MINNESOTA TECHNO-LOG



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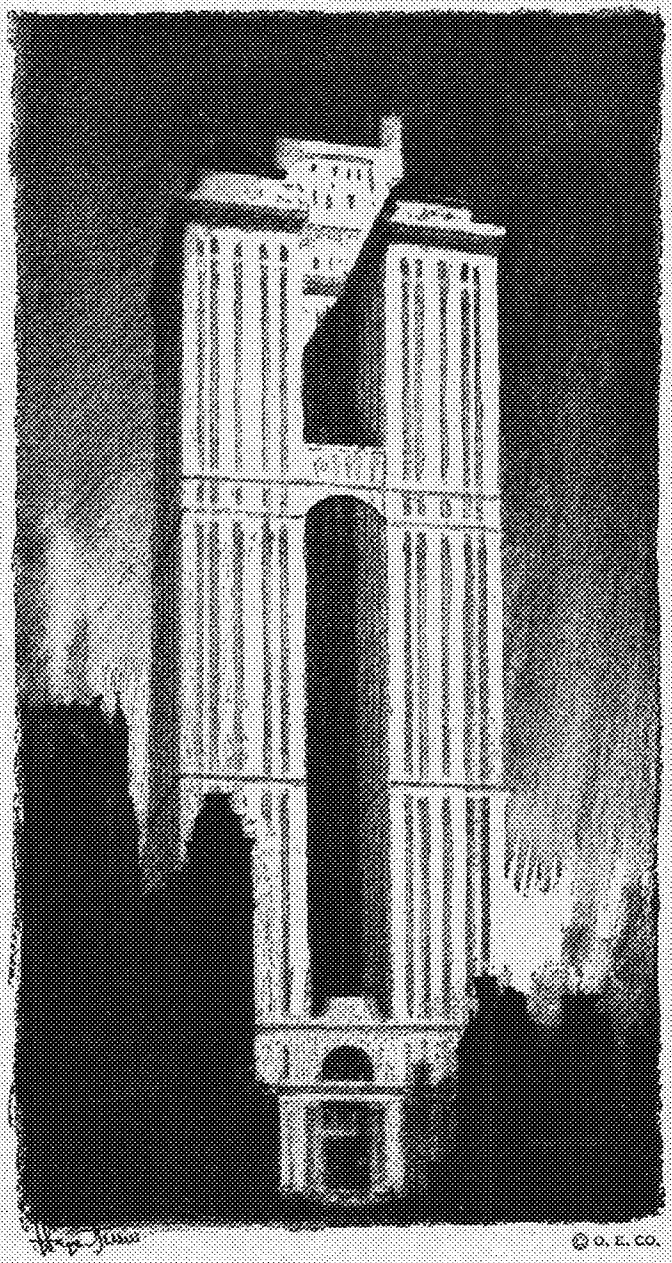

The Magnolia Petroleum Building, Dallas, Texas
ALFRED C. BOSSOM,
Architect

Drawn by Hugh Ferriss

"Sheer Height"

THE American business building represents a distinct and national architectural style when its design frankly emphasizes its sheer height and outwardly expresses the inner facts of its construction.

The tall buildings which stand as monuments throughout the country to the vision of our architects and the skill of our engineers have, in the gigantic profiles which they rear against the sky, the true American spirit of aspiration and progress toward even greater achievements.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

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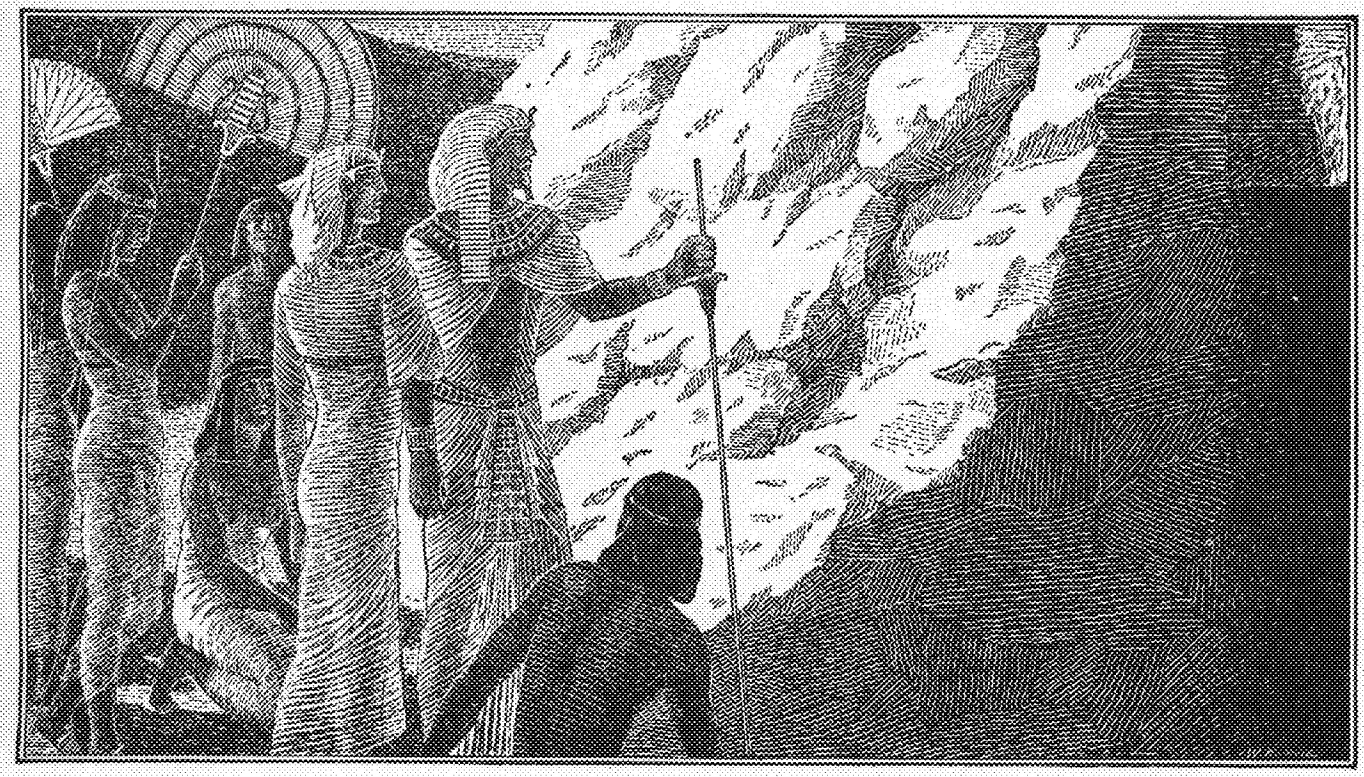

The Tomb of Tutankhamen

More than three thousand years have passed since Tutankhamen supervised the construction of his rock-hewn tomb. After he died, his paraphernalia of pomp and pleasure, war and worship, were laid away with him, because in those days the tomb was regarded as the eternal abode of the soul.

In Tutankhamen's time, gold, silver, copper, lead, and tin were mined; bronze vessels and tools were wrought and cast; large blocks of stone were quarried and long underground passages were driven.

These early Egyptians broke rock by driving wooden wedges into grooves chipped out with bronze tools. The swelling of the wedges, after they were wet with water, was sufficient to crack the stone. Thus they tunnelled the tomb of Tutankhamen.

The Pharaohs of Egypt had countless slaves at their command. Therefore, they disregarded labor costs. Far different is the situation of the modern miner, quarryman, or contractor. Now, even the concentrated energy of dynamite—the great labor-saver of this age—must be carefully conserved.

For work on which it is suited, there is no dynamite more economical than Hercules Special No. 1. It averages about one-third more cartridges per box than 40 percent dynamite, which it frequently replaces, cartridge for cartridge, thereby reducing explosives costs more than 25 percent. Hercules Special No. 1 contains nothing but the highest grade of standard materials and, on many kinds of work, has thoroughly proved its dependability.

Our booklet, *Volume Vs. Weight*, contains complete information on Hercules Special No. 1. Our general catalog is called *Hercules Products*. Write to our advertising department, 939 King Street, Wilmington, Delaware, for free copies.

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University of Minnesota

VOLUME III JUNE, 1923 NUMBER 8

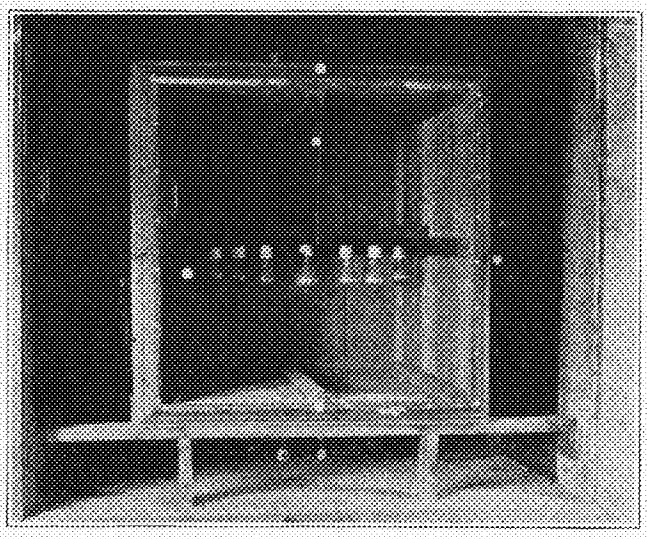
ENGINEERING RESEARCH WORK

Heat Transmission Tests, Run for More Than Two Years, Are Completed

By Professor Frank Rowley

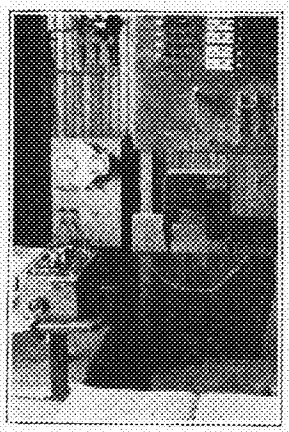
THE first part of a series of tests on heat transmission through building materials has been completed and will appear as a bulletin from the Engineering Experiment Station during the next month.

The object of this work, which has been in progress for the past two years, was first to develop a better method for determining the heat losses through building materials, second to determine the transmission constants of certain classes of insulating materials used in building construction, and third to determine the value of these materials as insulators of built-up wall sections.



Briefly it might be stated that there are two general methods in use for testing insulating materials: first, the hot plate and second the hot box method. In the hot plate method the material to be tested is placed between two metal plates, one hot which supplies the heat and the other cold which receives it. The heat given off by the hot plate is generally measured and from this the heat transmission constant for the material is calculated. By this method it will be noted that the surface resistance of the material is eliminated, since there is a metallic contact with the material surface. In the hot box method the material to be tested is placed over the open end of a box and the heat transmitted from the air on the inside to the air on the outside of the material. Or in other words the heat is transmitted from air to air through the material instead of metal to metal surface. This system does not interfere with the surface resistance and gives conditions more nearly equal to those met in building construction.

The apparatus used in this work was developed in the Experimental Laboratories and may be best explained by referring to Figure 1. It consists of two cubical boxes each with an open face, one placed within the other and with their open faces in the same plane. The material to be tested was placed across the open face of the two boxes and the contact sealed such that no air passed from one box to the other. The temperatures of the two boxes were maintained equal by electric heating elements and thermostatic control. By maintaining these temperatures higher than the outside surface of the wall, the heat is transmitted from the inside of the box through the wall surface. The area under test is that of the open face of the inner box. Since the temperatures of the inside and the outside box remain the same, no heat can pass from or into the inner box excepting that which passes through the wall surface. All heat which was supplied to the inner box was measured by an electric meter. With the total quantity of heat known together with the temperature drop, the heat transmission constant for the particular section under test could be determined. It will be noted that all heat from the inner box must pass through the wall in lines normal to the surface, since the area of the wall outside of the test section is supplied by heat from the outer box. The average temperatures of the inner and outer boxes were taken by copper constantan thermo-couples which were carried to a common terminal at the switchboard, and read with a Leed-Northrup potentiometer. The switchboard together with a control apparatus and meter is shown in Figure 2. The heating elements were so arranged that they might either be thrown on the constant current side or the thermostatic control side of the circuit, and thus regulate the load such that only a small part was thrown on and off by the thermostat.



In this series of tests the following materials were tested:

"A"—100 per cent flax straw fibre.

(Continued on page 18)

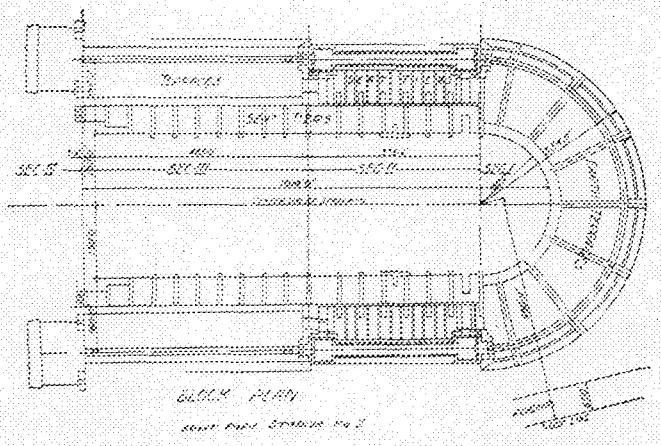
WIRING IN THE GRANT PARK STADIUM

Chicago's Huge Stand Presents Varied Problems to Electrical Engineer

By F. A. Byrne*

From a paper presented before the Western Society of Engineers, Sept. 25, 1922, as recorded in the Journal of that Society.

IN connection with a stadium it seems natural to associate athletic competitions, principally football games. This is quite proper, inasmuch as the presentation of such contests is the chief, and in most cases, the only use for which a stadium is designed. As a result the stadium is usually con-



sidered a daytime institution and very little attention has been given to artificial illumination for night use.

Such was not the case with the Grant Park Stadium. While the accommodation of the largest outdoor athletic contests was the chief factor in the design for the Grant Park Stadium, it was by no means the only one. It is also planned to accommodate pageants, military displays, theatrical presentations and all sorts of indoor expositions at night as well as during the day. This, of course, necessitated a comprehensive system of electric wiring for interior and exterior illumination.

The most unusual features of an installation of electric wiring such as required for the Grant Park Stadium are the great length of some of the conduit and cable runs and the concentration of control. The length of conduit and cable runs required is unusual, of course, only as compared with other low tension interior work. The length of the stadium physically is approximately 1,400 feet overall, but because of its plan it presents the same problem electrically as a building 2,800 feet long. There are other buildings as long and longer but these have all been equipped with ordinary lighting locally controlled.

The stadium is arranged for 12,000 volt, 3 phase service which will be brought in by duplicate cables to a main transformer vault in the west half of Section II, where they feed a bank of three single phase, 500 K.V.A., 12,000/2,300-volt transformers. The main distribution, within the stadium is at 2,300 volts, to six transformer vaults, one in each half of Sections I, II and III at the six-foot level just off the driveway in each case.

The wiring is divided into four groups, as follows:

1. For power.
2. For general lighting.
3. For arc and stage lighting.
4. For flood lighting.

Each system is independent of the others and is supplied by separate transformers and switchboards.

The power load amounts to approximately 350 H. P. or 260 K. W. All the motors being in Section I or in the near ends of Section II, the power is all supplied from a single bank of 12,000/440-volt transformers in main transformer vault in Section I. Motors operate at 440 volts, 3 phase.

General lighting is provided throughout the stadium, the main feature being that practically all of it is arranged for remote control. In general all of the lighting in any section is controlled from a central point in that section and in addition all of the lighting in all of the ramps, stairways and exits in all sections may be controlled from two main control stations near the center of Section I, one at elevation + 15 and one at elevation + 50. In the exhibition halls, nine circuits are provided at each ceiling outlet, the control being arranged in three steps, one-third each. Two circuits are provided to each exterior lighting standard and the control arranged for two steps.

Arc and stage lighting occurs only in Section I. Arc pockets are provided on each of the six searchlight pedestals on the upper level and around the rail at the field level. Four pockets for motion picture machines are provided at judges' stand. In each arena exit connection boxes are provided for feeders to stage lighting equipment.

Probably the most interesting feature of the wiring of the stadium is the provision made for flood lighting. Flood lighting an athletic field of the size in the Grant Park Stadium is not believed ever to have been attempted. The field to be illuminated is approximately 1,015 feet long by 300 feet wide, an area of 304,500 square feet. For this purpose there are provided 336 1,500-watt lamps in flood lighting projectors. This is a total of 504,000 watts or 1.65 watts per square foot of the area to be illuminated. Of the 336 projectors, 116 are mounted in Section II, 20 in Section I and 200 in Section III. In Section II the projectors are mounted in a permanent manner in the frieze of the colonnade. In Sections I and III they are mounted on removable poles, there being 22 poles, 10 projectors on each. All projectors are to be equipped with reflectors giving a beam spread of 30 per cent and adjusted so that the beams are approximately normal to the centerline of the field. The natural dispersion of the beam will illuminate across the entire field and together with stray light supply backlighting for

*Electrical Engineer, Holabird & Roche, Chicago.

(Continued on page 24)

A LITTLE GOSSIP ABOUT TYPOGRAPHY

Various Types of Type Developed as Result of Modern Methods of Type Founding

By Thomas E. Steward*

SINCE the time when mechanical processes of type-founding advanced to the point where a supply adequate to any possible demand for printing was assured, the point where print famine was banished and man became able to think of printing in other terms than those of mere volume, the main goals in type production and use have been three. These three are simple, being: To get type that is clearly and easily readable; to get type that, in additional to its readableness, is able to attract and win the reader's eye; to choose for a given manuscript the type that will best suit the character and spirit of the subject-matter. Although the first is by all odds the most practical and necessary, a progressive element of artistry rises through the three objectives.

For years after single type were first cast, in 1455, there were very few type faces. At first only the quaint, old blackletter Gothic type was cut, and the only language in which printing was done was Latin. When the German originators of type printed some Holy Writ in the German tongue, there was an uproar. Later in the fifteenth century, the first Roman face type were cut, at Venice, and there also, a few years later, the first of the sloping letters called "italic" were produced.

There have been multiform variations, but, from the reader's point of view at least, almost no fundamental changes in basic type classes since a decade or two before Columbus discovered America. A necessary amendment to this statement calls attention to the fact that the type called "Gothic" in the printer's catalog of today bears almost no relationship to the "Gothic" of Gutenberg and his contemporaries. Modern Gothic is the most severely simple type face now in use. Its "T" is an upright with a bar across the top. By contrast, the original Gothic, which few can read without unusual effort, looks like a very distant relative.

With the exception of our numerals, which are arabic, the types of today, "Gothic" and all, are Roman. The Americas, England, France, Italy and Spain print their books in Roman type. This indicates the overwhelming world popularity of an ancient and honorable letter. The "W," the "U" and the "J" have been added to the original alphabet cut in Roman type, which represented these sounds by "VV," "V," and "I," respectively. If one will expand the abbreviation "etc.," which many of us used to think was the last letter in the alphabet, through a complicated and baffling twenty-seventh, he will realize how Roman, alphabetically and typographically speaking, we are.

A distinction that will come constantly to the attention of the man choosing a type for his book, catalogue, pamphlet or advertisement, is that between the old-style and the modern type faces. Practically everything printed before 1835 in Roman type was in old-style Roman. Theodore L. De Vinne, a celebrated authority on printing in his "Plain Printing Types" makes this distinction:

"The general effect of the old-style is that of angularity; smoothness in curves and gracefully tapering lines are not attempted. The general effect of the modern face is that of roundness, precision and symmetry. As a bit of drawing, each letter in a modern face is exact and carefully finished in all its details."

Most of the popular types in use today can be obtained in either the modern or old-style faces, typography having retained for its uses all that was best in the past, together with the advantages of many fine type faces of more recent development.

In addition to the three primary considerations in choosing a type already mentioned the printer must have regard for the durability of his instruments. Some type faces wear much better than others. Where the hair lines and the serifs, or short cross lines put in as a finish at the ends of unconnected lines, are very weak, they are likely to become broken in use, with the result that the readableness and artistic value of the printing is impaired. In designing new type faces this point has always been recognized as important.

There is no end to the number of type faces from which one may select if he starts out with variety as his aim. Many of these are primarily display or special purpose types. The best place to keep a knowledge of the special purpose types is in a type founder's catalog, where a face suitable to one's uses in some unusual job can always be found. It must be borne in mind also that many of the headings, trade-marks and trade-names seen in advertisements, pamphlets and catalogs are not printed from true type at all, but from electrotypes made from drawn letters or words, especially designed for the job in hand.

Allowance must always be made for individual preferences, but for the greater part of typographical work today, the types with which one should be familiar are those called Caslon, Gothic, Cheltenham, De Vinne, Century, Goudy, Bodoni, Scotch-Roman, and the corresponding italics which can be obtained of most of them. Naturally, though, the type faces that incline to tallness and slenderness lend themselves to italicization much better than do the squat "fat" types. Lightface types are more often used in italics than boldface. The old English blackletter, a true Gothic form of type used by Caxton, who introduced printing to England, and long popular in that country, is now entirely out of use except as an initial, or in the kind of printing one would call "bizarre" or "quaint." The reign of blackletter was confined to the early days of printing, except in hymnals and prayer-books, and even those have long since been confined to more readable faces.

Of the types mentioned, Caslon and Bodoni bear the names of great type artists who have left permanent impressions on the printing industry.

*Editor, University of Minnesota News Service.

Neither of them, however, was an "early printer" in the sense of being a discoverer of the art or one who cradled it in infancy. The names of the great fathers of printing have been pretty well disconnected from actual type faces in everyday use, due to the vast number of changes and improvements that have come about. Louis Elzevir, a Dutch publisher of the seventeenth century, and the Italian, Giambattista Bodoni (1740-1813), both moderns, relatively, together with the English Caslons of the eighteenth and early nineteenth centuries, reach about as far back as any whose names now are connected with everyday type faces and terminology.

The early printers who made printing possible, and reading popular and delightful, were more especially: Johann Gutenberg of Mainz, Germany, credited with the origin of printing from movable types in 1455; Nicholas Jenson, who produced the first Roman face type at Venice in 1471; Aldus Manutius, a Roman and the son-in-law of Jenson, who first cut italic type at Venice, patterned supposedly on the handwriting of the great Petrarch; William Caxton, who printed the first book in England in 1477, and Wynken de Worde, successor to the Caxton shop upon the founder's death.

Aldus, inventor of italic, is credited also with being the first to invent that little handy friend of the busy man, the "keep moving" sign. His card, said to have been displayed at the printshop, read: "Whoever you are that wish to see Aldus, be brief; and when business is finished, go away." Some would have us believe that the stately Aldine way of putting that is as superior to the modern, "What, you here again!" as the early typography was to some of the later types.

France, rather than Italy, came near being the first country in which Roman type was cut, although it is open to question whether Jenson, had he worked in France, would have had the same inspirations for his work that he had in Italy, surrounded by carved Roman inscriptions. Nicholas Jenson was master of the royal mint at Tours, France. Charles VII of France sent him to Mainz to study type-cutting and printing under the masters there. But when he returned, having mastered the art, his patron was dead and the successor who ruled showed no interest in typography. Jenson promptly removed himself to Venice, where in 1871 the first Roman type was produced.

According to Edmund G. Gress, in "The Art and Practice of Typography," Aldus Manutius, Jenson's successor, had the assistance in the early sixteenth century of many famous scholars of Constantinople, who had fled that city after its capture by the Turks.

It is interesting to observe in connection with the spread of printing that an election squabble had much to do with the transfer of printing knowledge from Mainz to other European centers. In 1462, civil war broke out in Mainz between two archbishops, each of whom wished to be created "elector," with the power of casting a vote for the emperor. In the fighting much of the city was burned, among other establishments, that of Furst and Shoeffer, who had learned the art from Gutenberg. Workmen from the plant of Furst and Shoeffer fled to Holland, France, Switzerland, and to German cities other than Mainz. Printing knowledge spread amain. Gutenberg's shop, situated some distance from the center of the city, was undamaged.

Such modern types as De Vinne, Goudy, Century, Packard, and Curtis all are American products. Curtis was produced for the Curtis Publishing Company; Century for The Century Company, publishers. De Vinne won fame in his connection with The Riverside Press, Cambridge. Its books are known to every literate person.

Frank K. Walter, librarian at the University of Minnesota, points out in his "Library Printing," published by the American Library Association, that many of the highly practical and efficient types in current use are cut on a compromise between the old-style and modern faces. Among these he mentions Cheltenham, which is so popular in newspaper headlines; Scotch-Roman, and Kenilworth. Kenilworth is one of the many type faces cut by Fred W. Goudy of New York, a contemporary typographical artist whose name is borne by a popular type face, "Goudy."

When the printing committee of the University of Minnesota recently advised the substitution of "Pabst, old-style" for Old English type as the official letterhead of the institution, a suggestion which the administrative committee rejected with some horror, the committee paid a compliment to Mr. Goudy, who had brewed it.

One of the first things for the student of typography and make-up to grasp is that the use of capital letters has been sadly overdone in the past. The individual problem must always be the basis of judgment, but as a usual thing, apart from single lines of caps, display lines look better in lower-case, with only the first letter of the important words, or, in some cases, only the first letter of the first word, capitalized. The beginner must watch also his selection between light and boldface, also called blackface, types, and between the normal form of a type and its condensed and extra condensed forms. Newspapers, with narrow columns, confronted with the necessity of saying as much as possible in a very small space, have been an influence toward the condensed and extra condensed type forms, but in a line wider than a newspaper column these forms rapidly lose legibility.

Along the same line—one suggestion as to the use of color: Too free a use of color, unless dictated by a delicate sense of artistry, makes an ugly page. A very little color, used at just the right place to relieve the page, and to please and attract the eye, is the thing to be sought.

TIRE TROUBLE

Underinflation is the cause of nearly 50 per cent of tire trouble, according to the U. S. Rubber Company's technical department.

A tire is constructed with the idea that it is to be inflated to such an extent that it will retain its curved outline as the wheel revolves. If underinflated the portion which rests on the ground will flatten out instead of remaining curved. The plies of a tire are bound together by layers of rubber gum. There must then be no greater distortion of the plies than can be afforded by the layers of rubber. If the rubber is stretched too far it will be torn away from the fabric plies.

An interesting device which stimulates the qualities of sun-rays and will artificially test the fading qualities of different kinds of materials, as the fastness of colored cloths, paints, inks, varnishes, has been recently developed in the laboratories of the Cooper-Hewitt Electric Company.—*Michigan Technic.*

THE ARCHITECT'S AND THEIR JUBILEE

Many Unusual Costumes and Much Merriment Make Annual Affair Interesting

By Glanville Smith '24

"COPIED as closely as possible after the famous Bal des *Quarts* Arts"—to wit, rather sparkling, we infer—"in a setting of old fashioned batik" —but no, this is not the *Daily*. Ho hum! we'll have to get things straight after all.

Thus, to business! And since it is such a serious business we'll start with the committees.

Under John Walquist, president, these various chairmen wielded the sceptre, each in his own domain.

Decoration of Halls and Studio: Wallace Bonsall. (Poor Bonny! He had a corn between two of his toes before he was done, say nothing of a dislocated thumb from pressing home too many thumb tacks. The thumb could be more or less ignored—but how about that other item? His costume called for wooden shoes at the ball that night, you see.)

Decoration of the Auditorium: Eddie Holien, Izzy Silverman, Ted Krafft, Bill Woollett.

Construction; Lighting: Chuck Barnum, Roy Norman.

Play: Glanville Smith, Oswald Stageberg.

Coach: Carl Wise.

Music: Gladys Brouillard.

Frappé: Larry Tvedt. (This is what comes of being a Tau Beta Pi.)

Publicity: Sam Sutherland.

Tickets: Florence Knox, Dick Hennessey.

Invitations Design: Elving Johnson.

Patrons and Patronesses: Helen McGregor.

Alumni Invitations: Ted Sime.

Dansant: Alberta Eberhart, Dorothy Brink.

And remember—these are only the chairmen. Thousands of others served on the committees and aided in the general rumpus attendant on the lavish preparations.

One impressive scene deserves immortalization. To clear the auditorium of chairs a "bread-line" was formed all the way up to the storeroom. The chairs went up to the storeroom via the bread-line, and a momentous ride it was for most of them. Thus, in the twinkling of eye—the merest *augenblick*—the auditorium was cleared, really rather like magic. Magic? No, rather like a volcanic eruption, prompt, but devastating.

The Freshmen, meanwhile, were praticing *O Willy Dear* under Carl Wise, who in turn was under a new felt hat. Posters were being made, too,—giddy ones. Poster prizes were won by Joel Carlson, Robert Gustafson, and Iver Lauttamus. It was all very lively, those days.

And Friday came, as Friday will. And Friday afternoon found the Dansant in full swing, the tea boiling hot, and everything very gay.

But the "Quartz Arts" Ball was *the* event. Such quartz and quartz of art! Such a seething cauldron of color! Orange predominated with telling effect; the whole vivid scene became golden-hued in that gay setting. Great Pompeian jars—wobbly but effective—tent-poles and a quasi tent of orange streamers formed the major items of the decorative scheme, with red osier dogwood and other marshy shrubbery for a soft wall background, and Bill Woollett's dazzling batiks for the proper color accentuation. And the varicolored, polychrome, pied, particolored costumes of the dancers swimming in and out to the swooning harmonies and insistent rhythms of the music completed the mazey, fabulous, Alice-in-Wonderland ensemble.

O Willy Dear—vide Dick Hennessey's *Ballad of the Young Kid So High Out in the Country*—appeared in an intermission. A touching piece this, fortunately without a moral. The most striking single item in the performance was the wonderful ventriloquist effect obtained by King Rudolph. Each of his speeches began with a strange rumble (on stage) directly followed by a second passage (off stage) in tones cleverly reminiscent of John Grisdale, in turn followed by an up-and-down passage (on stage) which now and then strongly reminded us of Ole.

But this was to have been a business-like article. We'll have to return to the old track and set down the cast of characters in proper course.

Rudolph, King of Vaselino.....Erwin Bingham

Permadello.....Lawrence Lawson

Cuticura.....Irwin Clausen

Crisco.....Robert Gustafson

(There was something vaguely familiar in these three daughters, especially when Crisco cried, "Has the milkman come?")

Madame Marivaux .....Jerry Kronick

(O Jerry! Them rolling eyes! Them mellifluous accents!)

William, Prince of Orange Marmalade.....

.....Reggie Cowen

(He was in full court regalia with all his decorations, including two State Fair blue ribbons).

Sir Haskell Coffin .....Fred Grossman

Sir Neysa McMein.....William Rose

Sir Coles Phillips .....Paul Wickland

Sir Charles Dana Gibson .....Dewey Gerlach

Sir Clarence Under-Wood .....Lon Foss

(These characters, too, were reminiscent of others: Paul Wicklund as Sir Coles put us quite in mind of the patron of Saint Roychild's Abbey).

Page .....John Grisdale

(Miss Harwood to a T-square).

And then there was a chorus—"I've got those awful Cobalt Blues," with words by Dorothy Brink, music by Gladys Brouillard. And 'twas sung to a hitch-forward hitch-backward step, with a rec-

COLLEGE NEWS

ARCHITECTS

MAY DESIGN AWARDS

Several important design problems have passed before the jury this month, including the Magney and Tusler Inc. Prize Competition designs, and the Moorman Prize designs. In the former, two prizes were offered—$20.00 as a first prize, $10.00 as a second. The Moorman Prize, instituted by Mr. A. Moorman, of Saint Paul, entitles the winner to a fortnight's sojourn on the Eastern seaboard for the study of architectural examples there to be found.

The detailed list of awards is as follows:

SOPHOMORE SHORT:

Two Types of Windows

Credits plus:
R. V. McCann
W. B. Wedin
Alberta Eberhart
George Freeberg
A. E. Rigg
A. G. Lumm
Dorothy Brink

SOPHOMORE SHORT:

Headquarters for a Group of Learned Societies

Mention Commended:
Edwin W. Molander
W. B. Wedin

Mention:
Gladys Herniund
R. V. McCann
Oswald C. R. Stageberg
A. E. Rigg
Dorothy Brink

SOPHOMORE PRIZE ESQUISSE-ESQUISSE

A Railway Station for a Small Town

Mention Commended, Prize:
Edwin W. Molander

Mention:
W. B. Wedin
P. M. Havens
A. E. Rigg
Alberta Eberhart

SOPHOMORE ESQUISSE-ESQUISSE:

A Band Stand

Mention
Dorothy Brink
R. S. Lantz
Theodore Prichard
Homer Tatham

JUNIOR SHORT:

A Vase

Mention, Placed 1st, Held:
E. W. Krafft

Mention:
Rahel Rosenberg
Olaf S. Fjelde

JUNIOR LONG:

A Private Library

Mentions:
Paul E. Nystrom
H. A. Magoon
J. Elwood Isted
E. F. C. Backstrom

INTERIOR DECORATION, 1st:

Fireplace Accessories

Mention:
Olive Prescott
Florence Knox

INTERIOR DECORATION, 2nd:

An Italian Sala

Credits:
Arthur Ruddy
Florence Knox
Olive Prescott
Gladys Brouillard
Marion Petri
Carl Matthias Wise

SENIOR SHORT:

A Chapel Chancel

Mention Commended:
W. A. Backstrom

Mention:
E. L. Johnson
M. J. Markuson
Roy Boxmeyer

MAGNEY AND TUSLER INC. PRIZE COMPETITION ESQUISSE-ESQUISSE:

A Filling Station

Mention Commended, 1st Prize:
I. Woodner Silverman

Mention Commended, 2nd Prize:
Edward W. Hawkins

Mention:
Eddie Holien
Roy Boxmeyer
W. A. Backstrom

MOORMAN PRIZE COMPETITION, LONG:

A Building for the Beaux Arts Institute of Design

Mention Commended, Prize:
Eddie Holien

Mention:
I. Woodner Silverman
Edward W. Hawkins
E. F. C. Backstrom
M. J. Markuson
W. A. Backstrom
John Walquist

FRESHMAN DESIGN:

A Loggia in a Park

A—minus:
Bernice G. Kimmerle

B—plus:
Clyde Lighter
Irwin M. Clausen

B:
Mary G. Slocumb

NEW GAMBOLS OF CALABAN

"I see now why the *Daily* always speaks of us as the Department of Agriculture!" moaned Eddie Holien as he surveyed the contents of his drafting-room drawer one momentous Monday morning. That drawer! It resembled a potato patch at digging time in the fall. Not only was the soil which filled it rich in potatoes, but crockery, tin cans and other such impedimenta were brought to light with each new investigation. Wilbur's drawer was similarly freighted; his board-rack had been stuffed with yard on yard of toilet paper beside. Izzy, meanwhile, was staring stupefied into his files. There magazines, instrument case, water-color box, everything, had been filled with flesh-colored talcum powder—the kind guaranteed to stick (nor has the guarantee proved to be an empty vaunt). Other desks were loaded with bushels and bushels of fine shavings—a hijjus mess. What Calaban's mind could have planned all this deviltry?

While the mêlée consequent upon these startling discoveries was still at its height, in strode our Johnny. And as he strode he drew forth his key-ring, and selected therefrom the key to his desk. And as he strode, the key held before him in readiness for the lock, the light died within his hitherto jovial eye. His desk was not in place. Indeed, it was not even in the room; it had flown above-stairs to the Sophomore drafting-room, where, with a mocking slant to its straddled legs, it braced itself against descent from a proud eminence on the very summit of the coat-closet partitions.

Drafting-room business was resumed on the old basis only "aftah many yeahs of hahd labah." And we may add piously, Tel qui rit samedi, lundi pleurera. O Calaban! O Calaban!

And, speaking of discoveries, we may here recount, without fear of violating the canons of unity, mass, and coherence, a discovery made by Eunice on another momentous morning. What would be your emotions, gentle reader, if you should find in a drawer where, by all habit and custom, you were used to seeing only triangles, compasses, ink-bottles, books from the Library, and such architectural items, not them alone, but—

(We shudder.)

But, in addition, a fearful monster, whose claws opened and closed greedily, whose whiskers twiddled in the most forbidding manner, and whose beady eyes gleamed malice? Your emotions, gentle reader, were duplicated by those of our fair Eunice when she discovered a cray-fish in her drawer. O Calaban! Calaban!

And now comes a sequel, let unity, mass, and coherence go to smash if they choose.

"Call it Izzy!" cried one who shall be nameless, apropos of the cray-fish. "If you do I may get my name in the *Techno-log*."

Sketches by leading architects and draftsmen of the United States, Canada, China and many of the foreign countries will be the feature of the exhibit to be given by the Architectural Society in the Free Hand studio on the fourth floor of the Main Engineering Building from June 9 to 16.

The exhibit is being given by the society for the benefit of university students who are interested in such work. Prize winning designs by Birch Burdette Long will be on display, according to J. A. Wahlquist, president of the local society. The drawings were awarded prizes totaling $250.

The exhibit will include a variety of sketches made by pencil, water colors, and pen and ink, Mr. Wahlquist said. The studio will be open to the public every afternoon and evening during the week of the display.

O say does that confounded banner yet wave—

But no; we have been told often enough that singing is not our long suit—in fact, it more nearly resembles short pants. Let us therefore limit ourselves to prose.

The American Institute of Architects' Convention in Washington early this May, in which our department was represented by Mr. R. C. Jones, was made brilliant by a number of events, chief among which was a torch-light pageant down the long pool to the Lincoln Memorial, where Mr. Henry Bacon, the architect, was presented with the Institute Medal. In this pageant the various schools of architecture throughout the country were represented by delegates, each carrying a banner symbolic of his school. Minnesota's banner was carried by an early alumnus of the department—Mr. Howard Gilman, now of Washington.

The grand purpose of our banner was matched by a comic opera inception.

Behold Carl Matthias and Glanville descending upon Donaldson's at a quarter past five in the afternoon in quest of the materials. They made their five purchases, too, each in a different department. In vain did the closing-gong clang and clang: on they shopped, while the clerks either bit their lips in impatience, or laughed openly at the ridiculousness of the twain. The last of the five purchases was made up in the draperies realm—three golden tassels.

"Bring the books!
Bring the books!
Bring the books!"

the head of the department was intoning, with a mechanical swing of her arms for emphasis, when these two late-comers heaved into sight. But she, being of a heart of gold, snatched the tassels, snatched the transfer slip, and kangarooed to the elevator, Carl and Glanville chamoising along behind. The elevator dropped with a stomach-voiding thud: our trio rallied, leaped forth, and arrived at the transfer desk in two shakes of a lady-bug's hoof.

Here the trio dwindled again to a twain, which twain did battle with the army of clerks swarming for their lay-bys.

"Are you in the store?" drawled a plump menial in a green dress as she nonchalantly tossed a pair of shoes to one of the many Andersons.

"Why to be sure—no, I'm not either," replied Glanville lamely.

"My God!" breathed the menial, as she shifted her quid of gum from one cheek to the other, and threw a can of pineapple to another of the many Andersons.

And the many Andersons continued to fight for their lay-bys, most tumultuously. The banner materials were not neglected during all this turmoil, however: indeed they were going up and down the dumb-waiter with "incredulous speed," as Ivor said in *Chrome Yellow*. At last all twenty-two dollars' worth was wrapped, the check was made out, and our twain emerged with the last of the clerks. And they heaved a sigh of relief as the sounds of battle melted into the distance behind them.

Then behold Glanville making cartoons of a wondrous red, and the seamstress sewing and sewing; and at last at the peep o' dawn (9:30) on a Sunday's morning, Glanville, Izzy, and Carl hard at it, experimenting with various combinations of gilt, Chinese white, shellac, crayons, incantations, devilish swear-words—in a word, embarking on the actual painting process.

All that day they labored while the hours rushed past. They imbibed periodic eggs at the Sandwich Shop, and salted almonds now and then, and Teddy sang *O Promise Me*, and other gay ditties to lift the pall of tedium.

At ten that night the banner was *fini*, a most gladsome sight. And it was held this way and that, and viewed in all lights.

Next day the masterpiece was stowed in Mr. Hewitt's bag—Mr. Jones had departed earlier—and borne to Washington. There, let us trust, it turned up its gilded nose at all the other banners, like a true proud Minnesotan. Or, perhaps, like an equally true, but rarer Minnesotan, it knew its Walt Whitman, and was saying:

"For what are we, mere strips of cloth, profiting nothing,
Only flapping in the wind?"

But, indeed, should we expect such modesty of a banner of satin and gilt, carried in solemn processional on a southern mild May night?

Under the auspices of Alpha Alpha Gamma, Architectural Sorority, Mr. John Jager, graduate of the Vienna School of Architecture, gave a talk on "Japanese and Chinese Prints" in the Studio, November 21. Mr. Jager has traveled extensively in the Orient, making his collection of prints and ironwork. Comparison of Oriental and Occidental attitudes towards art, and methods of expression of the artistic impulse, comprised the chief part of his pleasantly informal and rambling address; and considerable notice was given to the "series" aspect of the hobby of print collection. Mr. Jager illustrated his points by the exhibition of prints from his own collection, many of which are of great rarity and value.

W. E. Willner, last year's president of the Architectural Society, is this year taking post-graduate work in architecture at the University of Pennsylvania; and steeping himself (professionally) in the atmosphere exhaled from Philadelphia polished-brass door-plates, Philadelphia brick, and Philadelphia cobble-stone streets. Mr. Willner, during the summer months, was awarded a First Mention on his design for "An Aquarium" in the Beaux-Arts Institute of Design, New York City.

Albert Buenger, E. E. '13, son of Professor and Mrs. Theodore Buenger of St. Paul, and Myrtle Rubbert ('22) were married the evening of August 30 at the home of the bride's parents. Mr. and Mrs. Buenger left on a wedding trip east, to return by way of the Great Lakes. Since October 15 they are at home at 1666 Stanford Ave., St. Paul.

Howard C. Kelsey, M. E. '22, is working for the Western Electric Co. He is located at Cicero, Illi-

CHEMISTS

CHEMISTS' PICNIC

Sailing, canoeing, picnicking, and dancing were some of the pastimes indulged in by the Chemists and their friends at Lake Minnetonka on Saturday, June 9th. The occasion was the windup for all social activities for the year in the School of Chemistry and as such was very well attended.

Taking advantage of the fair weather many students motored out to "Tonka" immediately after classes where they participated in almost every kind of outdoor recreation for the rest of the afternoon. Members of the fair sex joined with the boys in playing kittenball, some went sailing, and others to whom the lake was new took rides in the sight-seeing launch. When dusk came those who had not taken picnic supper along made a general stampede for sandwich stands, popcorn wagons, and other places for whatever kind of nutrition was available before they embarked for the Minnetonka Yacht Club where the sophomore and freshman Chemists sponsored a dance in the evening.

Here probably the best time to be had was enjoyed. About sixty couples danced till midnight, only leaving the floor to take an occasional canoe ride, or to respond to some other attraction of the moon-lit water. Music was furnished by "Shorty" Bunger's four piece orchestra.

Two kittenball contests which opened up the second round of the Chemistry kittenball tournament practically decided the champions of the four class teams entered. Of course the team that tops the list is that of our lusty juniors whose athletic supremacy still remains unquestioned. At their heels we find the budding sophomores who some day promise to displace the former from their throne of superiority. Next in order are the subdued seniors followed by the freshmen who gamely tried but lost.

Both games turned into routes that were perfect walk-aways for the victorious teams. The seniors were vanquished by the juniors by a 26 to 7 score whole the sophomores took their younger brothers under wing with a 39 to 11 score. The losers of both games can be accused of numerous fielding errors and with better playing, closer scores are expected in the remaining games.

Everybody ate and everybody listened. It was a perfect combination of gastronomic and mental stimulus and satisfaction. Where did this happen? At the freshman Chemists luncheon Thursday, May 17. The meeting served as a pleasant and last get-to-gether for the year at which the new officers, Joseph Kugler, president, Oscar Miller, vice-president, Kenneth Seely, secretary, Ole Schey, treasurer, and Edward Edelman, councilman, made their debut.

The meeting was presided over by Kenneth Peterson, retiring president, who introduced the speakers, Dr. Geiger (by now a good friend of the freshmen), Mr. Bakken, Miss Cohen, and the freshmen faculty advisor, Mr. Kirk. Some of the speakers felt it more or less their duty to amuse the yearlings but the serious aspect was also introduced when they were reminded that their freshman days are rapidly coming to a close and a few words by way of a cordial invitation to put in another appearance next year were rendered.

NH_4OH

Imagine a world in which ammonia took the place of water! What a life that would be—instead of "soda squirts" we should have "ammonia squirts," dispensing soda-ammonia; ducks would be classed as ammonia-fowl; and, if one of our friends attempted to develop will power by boycotting the bootlegger, we should speak of him as being "on the ammonia-wagon." These and many other conjectures were occasioned by the lectures of Dr. E. C. Franklin, May 16 and 17. Dr. Franklin, who is president of the American Chemical Society, has systematized and classified the ammonia compounds, and he gave us the opportunity of seeing things from the standpoint of ammonia instead of water as a standard.

That a striking analogy exists between ammonia and water was very clearly and forcefully demonstrated by Dr. Franklin. Pure ammonia, liquid at 125 pounds pressure or -33°C., dissolves salts as does water, and is an even better solvent for organic substances such as benzine and dyestuffs. As an example Dr. Franklin exhibited a solution of sugar which was very much like ordinary syrup. Salts separate from ammonia with ammonia of crystallization and from a solution in ammonia and water with both forms of crystallization. Some salts insoluble in water are soluble in ammonia, such as the silver halides and mercuric iodide.

He further demonstrated by the familiar method of the electric bulb that ammonia is a good dissociant. Like water, pure ammonia is a non-conductor, but a salt solution makes a very good electrolyte as the ions travel two or three times as fast as they do in water; hence, acids which are weak in water are much stronger in ammonia.

Since ammonia is so analogous to water, Dr. Franklin showed that there is a system of acids, bases, and salts based on ammonia as the dissociant in place of water, and he exhibited many of these substances which he had prepared. He termed substances based on water aquo compounds and those based on ammonia ammono compounds, defining an ammono base as ammonia with one hydrogen (ion) replaced by a positive element. He demonstrated that ammono acids and bases affect phenolphthalein in ammonia as the aquo ones in water and wrote many reactions of the unfamiliar ammono compounds. In relating the compounds of the two systems to each other he showed that cyananide is the carbonic acid of the ammono system. Likewise, hydrocyanic acid is ammono carbonous acid; potassium cyanide is ammono potassium carbonite; hydrazoic acid is ammono nitric acid, and a mixture of hydrazoic and hydrochloric acids constitutes ammono aqua regia! The ammono compounds undergo the same actions as those of the water system, and analogous to dehydration is deammonization which, however, takes place in three steps: from amide to imide to nitride. Dr. Franklin stated that all amides are mixed aquo-ammono acids. The ammono analogy to hydrolysis is ammonolysis, and amphoterism also takes place in the ammono system. It is here, perhaps, that the difference between the aquo and ammono systems is most evident, for amphoterism of ammono compounds produces some substances hitherto unknown, such as the plumbites, magnesiates, and nickelates.

MECHANICALS

A. S. M. E.

The student section of the A. S. M. E. elected officers for the next year at the regular meeting in April. Joseph A. Anderson received the presidency, Frank Morris was elected vice-president, Smith Eggleston, secretary and Kenneth Ross, treasurer.

Dr. Prosser, of Dunwoody Institute, talked on labor problems. He stressed three main points from the standpoint of the engineer. He traced the change of the source of labor supply, and the disappearance of trades and trained workers.

The quality of labor has been reduced and fewer men are entering trades, the modern specialization of labor making the employment and living of the inefficient class possible.

The immigration laws practically require the American manufacturer to train his own labor and to substitute as much machinery for men as he can.

Dr. Prosser believes that the employers do not praise their men enough, but treat them similiar to so many machines. They think the pay envelope is the way to get satisfactory work from the men, but loyalty and the will to work cannot be bought.

Pi Tau Sigma announces the election of: Professor J. J. Flather, Stanley B. Tuttle, John W. Wagner, Frank A. Morris, Hamlet C. Olien, Paul M. Boyd, Arthur S. Peterson, and William J. Darmody.

After the initiation on May 17, the fraternity held a banquet at the Curtis Hotel. The program was featured by talks from the new as well as the older members.

The Twin City and student sections of the A. S. M. E. held a joint meeting May 24. At 4:30 tests and stunts with the experimental equipment started the proceedings. Supper at the Union was then in order and at 7:30 the main program started.

C. F. Olmstead read a paper on the results of his tests on oil burners for domestic use.

Professor Rowley talked about his work on boiler performance at the Munsingwear plant.

Arthur Kumm with his banjo, and the Mechanical Quartet furnished the necessary entertainment.

Additions to Mechanical Engineering Shops

A portable core-oven has been added recently to the foundry equipment.

The pattern shop equipment has been extended to include a sanding machine with horizontal and vertical shafts, and a new band-saw.

The enrollment in the department of mechanical engineering for the fall quarter 1922-23 is 111.

The membership of the American Society of Mechanical Engineers includes over 16,000 professional engineers.

There are six grades of membership in the A. S. M. E.: honorary member, member, associate, associate member, junior member, and student member. The grade of membership of a member is determined by the extent of his education, practice of his profession, or his relation to the arts or industries.

A. W. Luce, of the M. E. class of '21, has returned to the College of Engineering this year for graduate study and research work.

TECHNICALITIES

Patron—"Please bring me the sugar."

Waitress—"Fine or cut plug?"

Patron—"Oh, just as you chews."

"Did you ever hear the story about the Golden Fleece?"

"No, do they bite?"

It has been said that a horse can bite with all his might, but not with all his mane.

Fond Mater—"Are your manners good? How do you eat your meals?"

Flippant Frosh—"One at a time."

—Northwestern Purple Parrot.

An Eastern college graduate applied for work in a Michigan lumber camp, and was assigned to one end of a cross-saw, the other end being in charge of an old and experienced lumberman. At the end of an hour, the veteran stopped sawing and regarded his weary partner with pitying eyes.

"Sonny," he said, "I don't mind your riding on the saw, but if it's just the same to you, I wish you'd quit scraping your feet on the ground."

—The Forecast.

Track Coach: "What are you going to run, the mile or the two-mile?"

Runner: "I don't know. I can tell you better after the first mile."

"Might I ask you for this dance?"

"Yes, please do. I've been just dying to refuse you all evening."

"Is Miss Blank in?"

"No, sir."

"Just ask her again, will you? She may have changed her mind."

"The mice would just go crazy over him."

"How come?"

"He's such a big cheese."

Newrich: "I want my portrait painted."

Artist: "In oils?"

Newrich: "Whaddya think I am, a sardine?"

Lady (slightly hard of hearing): "What is the name of that piece they are playing for the shimmy?"

Gentleman: "The 'Vamp.'"

Lady (who had been watching the contortions of the dancers): "O yes, of course, the 'Cramp.'"

Mother: "Richard writes that he has been burning the midnight oil every night for a week."

Father: "Yes, he'll have the old bus worn out if he keeps on."

First Barber: "Nasty cut you've given that old gent, Bill."

Second Barber: "Yes, I'm courtin' his 'ousemaid. That's to let 'er know I can see 'er Tuesday night."

The girl had jilted her sweetheart; and he said as he slipped the ring she had returned to him into his waistcoat pocket:

"Who has supplanted me?"

"I don't like to tell you," she answered.

"Yes, tell me!" he insisted. "Give me his name and address."

"No, Harold, no!" said the girl. "You want to kill him."

"No, I don't," said Harold. "I only want to sell him this ring."

Interviewer: "And so you make your gigantic fortune manufacturing just simple rubber bands? Surely, you must have a business motto. What is it?"

Rubber Band King: "Make it snappy."

A cynic says, after making a survey of the ambitious unemployed: "Ninety per cent are looking for positions; eight per cent are looking for jobs; and two per cent are looking for work."

Motorist (arrested for speeding): "Hello, Judge! How are you this morning?"

Judge: "Fine—thirty dollars."

First Convict: "When I get out of here I'm going to have a hot time, ain't you?"

Second Ditto: "I dunno. I'm in for life."

Father (sternly): "I see that you and your young man have gotten so far as to sit on the sofa together."

Daughter: "Yes—sofa so good."

"What's your little girl's name?" asked the colored parson of the lady who was enrolling her daughter in his Sunday school class.

"Her name am Opium Bryant," was the reply.

"'Opium?' That's rather an odd name for a girl," ventured the parson. "How did you ever come to pick that name?"

"Y' see, pahson, 'twas dissaway. Dey say opium comes from wild poppy, an' so when dis chile was bohn, ah decided to name her Opium 'cause her poppy suah am wild."—Judge.

"Why do you call that cigar the 'Salome'?"

"Because its wrapper is missing."—Exchange.

Judge—"Now I don't expect to see you here again, Rufus."

Rufus—"Not to see me here again, Judge? Why, yo' ain't a-going to resign yo' job, is you, Judge?"

A Long Island contractor, driving in from Rockaway Park, came upon another whose machine had broken down on the road. "Need any assistance?" inquired the contractor courteously.

The other man lifted his flushed and grimy face from under the hood. "Yes," he replied. "I wish you'd answer my wife's questions while I'm fixing this infernal engine."

Her Little Extravagance

Mandy—"I'se decided to leave mah husban'."

Maude—"How come? Is you beginnin' to economize?"—Life.

A wife's farewell to her husband every morning: "Buy, buy."—Exchange.

"That's a hard one to beat," remarked the scientist as he picked up a petrified egg.—The Sagebrush.

When you tell a man something, it goes in one ear and out the other; when you tell a woman something it goes in both ears and comes out of her mouth.—Michigan Gargoyle.

Frat: "Why did the boss fire you from that job?"

Pin: "Well you know a labor boss is one who stands around and watches his gang work?"

Frat: Yes! yes! What's that got to do with it?"

Pin: "Well, he got jealous of me. People thought I was the boss."

Kisses

First Kiss (nothing else will do).
Last Kiss (should be abolished).
Stolen Kiss (returnable if undamaged).
Co-ed Kiss (assorted colors).
Lover's Kiss (makes the world go 'round and 'round).
Married Kiss (not necessary).
Platonic Kiss (extinct).
Soul Kiss (obsolete).
Moonlight Kiss (hallucination).
Taxicab Kiss (damnation).
Djer Kiss (special sample offer).
Girl to Girl Kiss (inexcusable).
Every Kiss (inexplainable).
No Kiss (unforgivable).

—Columbia Jester.

"You certainly have a trim little waist."

"Yes, there's no getting around that."

"My girl reminds me of washday."

"How's that?"

"Nothing to her but clothes, pins, and a heavy line."

—Fun.

When a man stands aside to let a woman board a car, you can't tell whether it's chivalry or curiosity.

STADIUM DRIVE

The School of Chemistry is one hundred per cent for the Memorial Stadium and Auditorium. This was shown not only by the subscriptions of the students and faculty but by the spirit in which they were given. And it was that spirit, along with the co-operation between the students and solicitors, and their desire to do their utmost for these worthy memorials, that put the drive over. After the first day when both the School of Mines and the School of Forestry had reported 100 per cent, it was unknown who would be the third to reach the goal. On the third day of the campaign, at 10:45 a. m., to be exact, just thirty-four hours and forty-five minutes after the first boom of the gun, the School of Chemistry went over the top—100 per cent. The amount subscribed by the 125 subscribers was $11,415.00, or an average of $91.21 per subscription.

A great deal of credit for the success of this campaign, in the School of Chemistry, is due Richard L. Rademacher. Under his leadership the teams worked at top speed to put the campaigning over in the shortest possible manner with the best results. The members of the teams are as follows: Team No. 1—Adeline Feige, Capt.; John McKee, Harry Doran, Karl Paul, Charles Milkes, and Alvin Fuhrman. Team No. 2—Lloyd Hatch, Capt.; Donald Dukelow, Richard Harvey, Lester Eck, Robert White, and Hubert Frederickson. Team No. 3—Ernest Jewett, Capt.; Kenneth Peterson, Albert Becker, Ernest Griffith, Bruce Weetman, and Douglas McHenry. Graduate Team—Norman Cassel, Capt.; A. C. Bakken, Kirk Thomas, and Arthur Beckel.

Ernest A. Nordstrom, M. E. '22, is working for the Standard Oil Co. in St. Paul.

Clayton E. Hemsey, M. E. '22, is located with the Western Electric Co. in New York.

Walter K. Cook, C. E. '22, is working on construction of the Mille Lac county courthouse. Mr. Cook is with Croft & Boerner, Architects and Engineers.

R. R. Simmonds, C. E. '21, is working as Resident Engineer at Amasa, Michigan, for the Michigan State Highway Department.

E. L. Hanson, who has been in New Mexico during the summer, is working for the Reinforcing Steel Company, Los Angeles, California.

Loring Slade, C. E. '22, is working at Grand Marais, for the Minnesota State Highway Department.

Ben Wilk, C. E. '13, Secretary of the Chicago Chapter of the Minnesota Alumni Association, is employed in the Service Department of the Universal Portland Cement Company.

Senor Alejandro Bunge, professor of economics and statistics in the University of Buenos Aires, says that most of the South American firms are anxious to take in American engineers, as they have great respect for northern ingenuity and energy. It is, however, difficult for a foreign engineer to make an independent start, as South America does not have reciprocity with other countries, and to obtain a license it is necessary to pass rigid examinations. He also expressed the opinion that one of the largest fields lay in the introduction of American methods of cheap construction, frame buildings, stucco, and hollow tile, as brick and stone have been used almost entirely in past years. The social position of the engineers, according to Prof. Bunge, is

ENGINEERING RESEARCH

(Continued from page 5)

"B"—100 per cent wood pulp.
"C"—Sugar cane fibre (hard pressed).
"D"—Sugar cane fibre (spongy).
"E"—Cereal straw (100 per cent rye straw).
"F"—Animal hair sewed between two layers of paper, loose approximately 3/8" thick.
"G"—Paper pulp keyed for plaster base.
"H"—Beveled lath mounted on tar covered cardboard.
"I"—Alternate layers of plaster and four layers of paper. Total thickness approximately 3/8".
"J"—Flax fibre straw stitched between wrapping paper, loosely matted, approximately 3/8" thick.
"K"—Sea grass, loosely matted, stitched between two layers of paper, approximately 1/2" thick.
"L"—Same as "A" covered with 1/16" asbestos paper on each side.
"M"—Same as "A," keyed with wood lath for plaster base.
"N"—Black building paper.
"O"—Red building paper.
"P"—Same as "G," covered on one side with 3/8" wood fibre plaster.
"Q"—Same as "B," covered on one side with 3/8" wood fibre plaster.
"R"—Same as "A," covered on one side with black paper, standard beveled lath and 3/8" wood fibre plaster.
"S"—Same as "C," with 3/8" wood fibre plaster on one side.
"T"—50 per cent flax and 50 per cent rye straw fibre. Similar to "E," surface depressions not so prominent.

In general it was found that loosely matted insulating materials gave better results than the hard pressed boards. Of the insulating boards which are used primarily as insulators an average value for the heat transmission constant, "K,"* is .35 to .40. It was found that the materials of the same stock would vary somewhat in thickness and quality, and in some cases variations as high as 20 per cent were noted in insulating value of materials from the same stock. Of two materials which were of the same thickness but of different density, the lighter material would invariably give the better results.

In order to determine the value of these materials in building construction, several wall sections were built up part with insulating materials and part without, the construction following as closely as possible to standard practice. From these tests it was shown that if one-half inch insulating material is placed between the studding of an average wall, that is, one constructed with plaster on the inside and sheathing, tar paper and drop siding on the outside, a saving of 26 per cent in heat loss is effected. This same insulated wall will effect a saving of over 50 per cent on a wall which is constructed of metal lath and plaster for the inside surface, and metal lath and stucco with back plaster for outside surface. In general, it appears that the best insulation is obtained by placing the insulating material between the studding, thereby breaking up the air space in two sections.

*Heat transmission constant, "K," is the number of British thermal units transmitted through 1 sq. ft. of the surface per degree difference in temperature per hour.

The Notes announces a new series of honorary fraternities, to be known as the Chi series. Chi having C for a letter of introduction, we are letting Chi stand for CON. For instance, we could then organize Chi Mu Beta, Chi meaning Con; Mu, by virtue of its M, meaning Mechanics, and Beta, being the second letter of the Math alphabet, standing for two. Chi Mu Beta would thus take in only those who have CONNED MECHANICS TWO.—Wisconsin Engineer.

P. D. Remple is in the Exchange Department of the same company. No, he does not handle calls himself.

N. S. Anderson, C. E. '22, is now located in the Pioneer Bldg., St. Paul, with Shuett and Meier, structural engineers.

Cyril Jenson, C. E. '21, has left the Highway department, and is now on the St. Croix River at Nevers Dam, Wis., in geological investigation there.

Irving Aske, E. E. '20, is the President and General Manager of the Kase Electrical Co., of Duluth, Minn. His work has been in connection with the invention and design of electrical equipment for automobiles.

John Manuson, E. E. '22, is now relief foreman in the Electrical Department of the Minnesota Steel Co., Morgan R. R., Duluth. He was formerly Night Electric Superintendent.

P. Rosenthal, C. E. '22, is leaving St. Cloud where he has been with the Highway department on bridge construction. His new position is at Milwaukee, Wis., with the Warren Allen Co., Consulting Engineers and Contractors, specializing in the erection of steel frame structures.

"What are you going to do this summer?" is the popular question of the Frosh, Sophomores, and Juniors. The Seniors are looking for something more permanent. By reports, engineering work will open this summer as it hasn't for years. Surveying positions are being rapidly filled, and many more will learn the song of the transit-man this season.

The Bhandardara irrigation dam near Nasik, India, will soon be completed and will be 250 feet high, storing the greatest depth of water of any dam yet completed.

THE JUBILEE

(Continued from page 9)

tifying stagger between stanzas. Ah me! How soon these toiled-over productions slide down into drab history and the oblivion of Techno-log articles!

Then on swam the dancers again, while the music cooed and blahhed.

Prizes for the best costumes were awarded Dorothy Brink and John Walquist. Dorothy was attired as a Countess Tuttess of ancient Egypt, recently exhumed, no doubt, from the much advertised tomb. And Johnny—here is where we shed a large and pearly tear—won his prize as an angel. An angel! Ah! The mysterious workings and the ironies of Fate! Our Johnny, who has toiled so long and long, so much and much for us, sans prizes, sans honors, sans everything, at the very close of his career is honored for appearing in dimity, haloed, winged, and altogether heavenly. Yea—he has earned a reward in Heaven, and hence can afford to smile on this tardy and jesting honor vouchsafed him here below. Amen!

Amen nothing! We almost forgot the patrons and patronesses. (Remember that this is a business-like article, if you please!) They were:

President and Mrs. Coffman
Dean and Mrs. Leland
Professor and Mrs. Mann
Professor and Mrs. Krey
Doctor and Mrs. Holman.

The chaperones were:

Professor and Mrs. Forsythe
Professor and Mrs. R. T. Jones.

TECHNICALITIES

He—"My, but that's a beautiful arm you have."
She—"Yes, I got that playing basketball."
He—"Did you ever play football?"
—Fun.

Eve (from the bushes)—"Adam, dear, close your eyes so I can come home."
Adam—"What's the matter, my own?"
Eve—"I've been A. W. O. L."
—Fun.

THIS IS A DEEP ONE

Sunday School Teacher—"And Nebuchadnezzar was in the midst of his riotous orgy, when looking up he saw the handwriting on the wall. Now can any of you little girls and boys tell me what words he saw?"
Smart Aleck—"Watch your coat and hat."

He—"I'm a little stiff from polo."
She—"Why didn't you say so before, why, I have some friends living there."

WISE BOY

"Oh! tell me, Adam, tell me,"
Fair Eve quaintly said,
"Why do you hate the summer
And pray for cold instead?"

Then Adam softly answered
In sort of foolish drawl,
"I'm not so much for winter
'Till the leaves begin to fall."
—The Magazine of Fun.

INDUSTRIAL LIGHTING CODES.

In order to protect workers from accidents and eye sight damage, no less than five states, New York, New Jersey, Pennsylvania, Wisconsin and Oregon have now in force lighting codes for industrial establishments. Other states are now considering the adoption of an industrial lighting code, and it seems only a question of time when all the states will adopt such a code.

Proper lighting of work places is not only of great importance to the operators working therein, directly affecting their safety and eyesight, but it is a factor of equal importance to the employer, as quality and quantity of output are deciding factors of profit or loss in the operation of the plant.

The introduction to the Wisconsin code reads as follows: "Insufficient and improperly applied illumination is a prolific cause of industrial accidents. In the past few years numerous investigators, studying the cause of accidents, have found that the accident rate in plants with poor lighting is higher than similar plants which are well illuminated. Factories which have installed approved lighting have experienced reductions in their accidents which are very gratifying.

"Of even greater importance, poor lighting impairs vision. Because diminution of eyesight from this cause is gradual, it may take the individual years to become aware of it.

"This makes it all the more important to guard against the insidious effects of dim illumination, of glaring light sources shining in the eyes, of flickering light, of sharp shadows, of glare reflected from polished parts of work. To conserve the eyesight of the working class is a distinct economic gain to the state, but regardless of that, humanitarian considerations demand it.

"Finally, inadequate illumination decreases the production of the industries of the state, and to that extent, the wealth of its people. Factory managers who have installed improved illumination, are unanimous in the conviction that better lighting increases production and decreases spoilage."

The Wisconsin Commission has adopted a rule to the effect that, "diffusive or refractive window glass shall be used for the purpose of improving day light conditions or for the avoidance of eye strain, wherever the location of the work is such that the worker must face large window areas, through which excessively bright light may at times enter the building."

A glass is now available which meets the above requirements. It properly diffuses the light and prevents sun glare passing into the building and is known as Factrolite.

Engineers of to-day are making a thorough study of illumination, so that they may be able to plan and lay out industrial plants, to scientifically increase their efficiency to as near the maximum as possible. This accomplished the engineer is not only doing something worth while for his employer, but is doing quite as much for himself by coming into prominence with modern ideas.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.

220 Fifth Avenue,

St. Louis. New York. Chicago.

No. 8.

STADIUM WIRING

(Continued from page 8)

the spectators. To shield observers on the opposite side from glare, the projectors will be equipped with semi-circular shields around the top half. Some tests were made to determine the relative merits of dispersion or refractor type lenses as compared with clear glass doors for use on the projectors. It was found that, except when the eye looked directly into the beam, the projector with a clear glass door was less objectionable from glare than when equipped with refractor lenses. It was also determined that the angle of incident light should not be less than 25 degrees.

The flood lighting is arranged for control in three steps, one-third each, from the two main control stations in Section I.

The total load of the stadium is approximately 1,514 K. W., made up of 260 K. W. power, 504 K. W. flood lighting, 250 K. W. arc and stage lighting, and 500 K. W. general lighting.

The foregoing description relates to the complete project. Considerable modifications were made to accommodate the changes made in the plans in connection with the partial construction now under way.

M. B. Bergstrom, '22, has had the misfortune to fall ill with diphtheria while home on his Christmas vacation.

A dry cell, put through the same test, reduced its voltage at 115 below zero and at 170 degrees reversed its voltage.

Lynn W. Eddy, E. E. '07, is in the engineering department of the Western Electric Company, Hawthorne, Chicago.

A. C. "Jess" Willard, '22, is at present enjoying the peaceful Quaker life in Philadelphia, where he is sojourning on power sales work.

L. T. Johnson, E. E. '10, made a flying visit to the University in September. He is electrical and mechanical engineer for W. J. Rainey, Inc., coal miners at Uniontown, Pa.

L. H. Knapp, E. E. '12, is industrial heating engineer with the General Electric Co. Mr. Knapp has a leading article on the "Status of Electric Furnaces" in the Electrical World of Sept. 16, 1922.

Bob Steffans, '22, who is here representing the Westinghouse Electric and Manufacturing Co., to tell the senior electricals of opportunities with that company, gives us the following news of those with Westinghouse:

Sam Berg, '20, H. Dahl, '22, and Bob Steffans are under the guiding hand of Mr. B. G. Lamme, chief engineer, in the engineering school; Berg is going into application work, Dahl is undecided, and Steffans is specializing in heat engineering.

Experiments recently made at the Bureau of Standards by G. W. Vinal and F. W. Altrup show that at 170 degrees below zero C., both storage and dry cell batteries reverse their voltage.

It was observed in the storage battery test that at 80 degrees below the voltage was normal, that between 80 and 100 degrees below there was a slight increment of voltage, while from 100 to 170 the voltage fluctuated between 10 minus and 10 plus. The cell when brought back to normal temperature showed no ill effects from the chilling, and delivered its rating.

PORTRAIT OF  SIR ISAAC NEWTON

James II is Dead— NEWTON Lives

IT has always been known that free bodies fall. The earth has a strange attraction. How far does it extend? No one knew before Newton, sitting in his garden, one day in 1665, began to speculate.

"Why should not the attraction of gravitation reach as far as the moon?" he asked himself. "And if so, perhaps she is retained in her orbit thereby." He began the calculation, but overwhelmed by the stupendous result that he foresaw, he had to beg a friend to complete it.

In Newton's *Principia* were laid down his famous laws of motion —the basis of all modern engineering. The universe was proved to be a huge mechanism, the parts of which are held togetner in accordance with the great law of gravitation.

James II was reigning when the *Principia* appeared in 1687. He is remembered for the Bloody Assizes of Jeffreys, for his complete disregard of constitutional liberties, for his secret compacts with Louis XIV and the huge bribes that he took from that monarch, and for the revolution that cost him his crown; Newton is remembered because he created a new world of thought, because he enabled scientists and engineers who came after him to grapple more effectively with the forces of nature.

When, for instance, the Research Laboratories of the General Electric Company determine the stresses set up in a steam turbine by the enormous centrifugal forces generated as the rotor spins, they practically apply Newton's laws in reaching conclusions that are of the utmost value to the designing engineer.

General Electric
General Office Company *Schenectady, N.Y.*

95-60D