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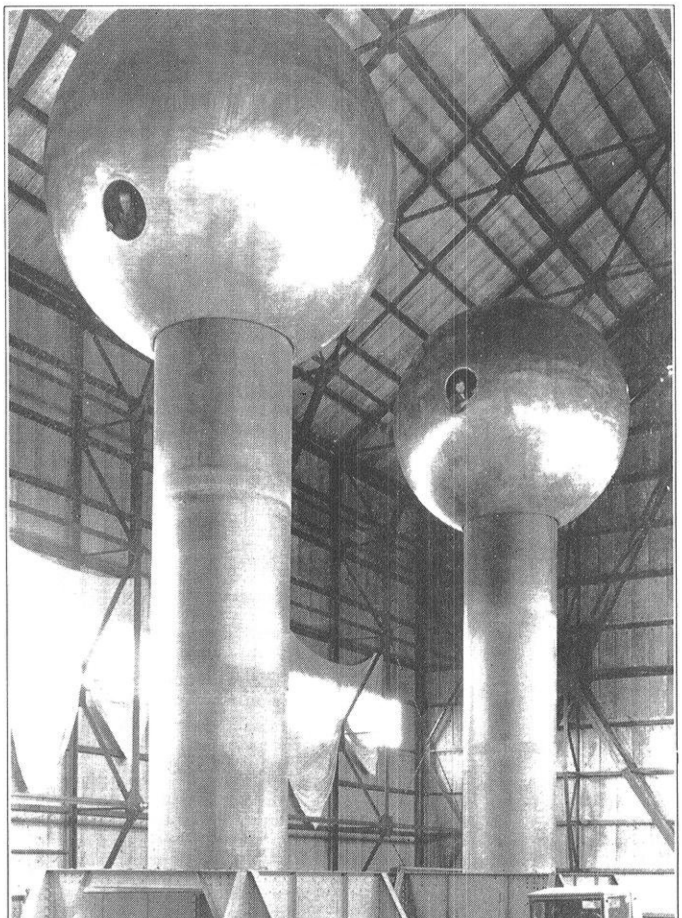
THE WISCONSIN ENGINEER



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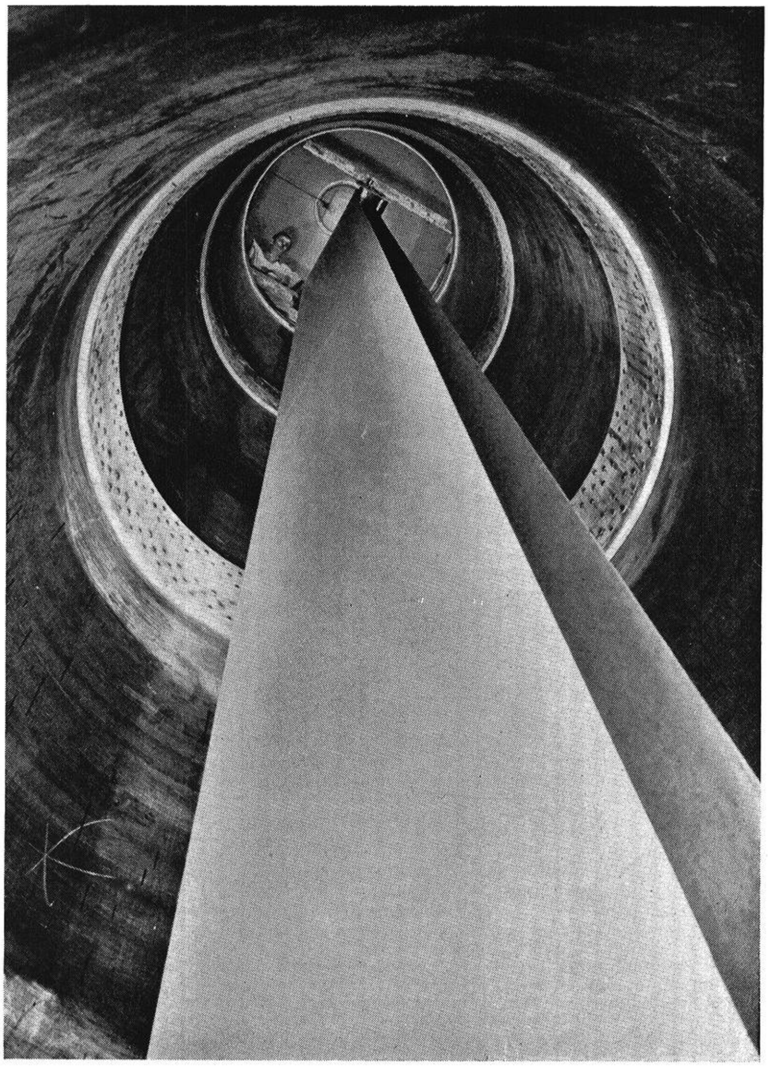


—Courtesy Tech. Engineering News.

Looking Up Through the Terminal of the Ten Million Volt Generator

The WISCONSIN ENGINEER

VOLUME 38, NO. 4 JANUARY, 1934

The Ten Million Volt Generator

THE gigantic electrostatic generator at the Massachusetts Institute of Technology may appear to be of a rather complex nature, but actually it operates on the simple principle of the familiar ice-pail experiment of Faraday. The outgrowth of Faraday's experiment is the Van de Graaff electrostatic generator shown on the cover. The photo gives an idea of the immense size of the upright columns supporting spheres which serve as reservoirs for storing the electrical charges. The hollow spheres, which are fifteen feet in diameter and weigh 3000 lbs. each, are constructed of twelve sections of ¼″ aluminum alloy joined together by butt welds. After the welds were ground smooth, the entire surface was polished and waxed. The smooth surface and the large size of the spheres are necessary to reduce the corona discharge which is common at high potentials.

The upright columns are six feet in diameter and more than twenty feet in height. The material used in the construction of the towers had to have high insulating properties as well as the necessary mechanical strength to support the heavy spheres. Textolite, a material manufactured by binding layers of paper together with shellac under high pressure and temperature, was found to meet the specifications very well. Molten ceresin was used to impregnate the exterior of the columns so that leakage due to surface moisture could be minimized. The resistance of the impregnated column is so high that only thirty microamperes pass to ground when the sphere is charged to a potential of three million volts. The design of the columns permits a spherical terminal to be charged to over five million volts before a flashover to ground occurs. These spherical terminals are charged by two paper belts inside of the columns. A charge, imparted to the belt at the foot of the column, is carried up to the sphere where it is discharged. The paper belts are four feet wide and seventeen mils thick and operate under a tension of one-thousand pounds, the breaking load being about six thousand pounds. Paper was used chiefly because of its comparatively small cost. The insulating quality is quite good, and no mechanical difficulties have presented themselves even though the belt is run at a speed of over sixty miles per hour.

At the base of the column a ten horsepower motor drives the belt which receives its charge from a "corona" wire one inch away from the belt and charged to a potential of twenty thousand volts. This high potential, which is obtained from a kenotron rectifier set, causes a large number of charges to move towards the belt where they are deposited and carried upwards. At the top, a similar wire is enclosed in and attached to a metal shield (in effect, a Faraday ice-pail) which collects the charges just before they reach the upper pulley, and deposits them on the sphere. On the other side of the pulley where the belt is moving down, another "corona" wire is used to impart to the belt the charges of undesirable polarity from the sphere. At the lower end, the belt is discharged in a similar manner. While one machine is storing up negative charges on one sphere, the other is storing up positive electricity on the other sphere, so that when each sphere is charged to five million volts, the potential for which they were designed, the potential existing between the two spheres is ten million volts.

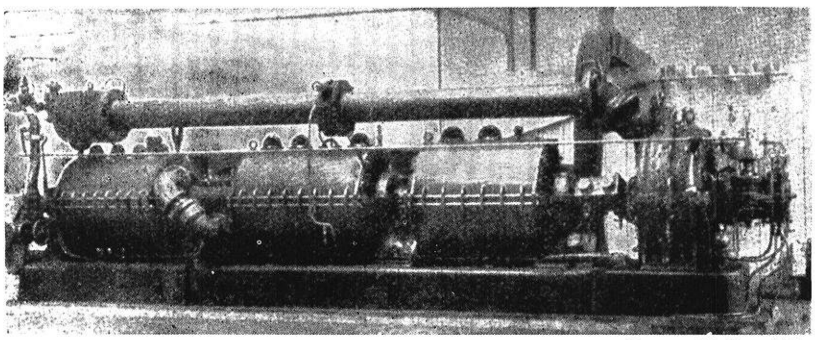
It is obviously impossible to measure the voltage of the generator by means of a voltmeter connected between the two spheres. Modern radio technique has made it possible to measure the strength of the electrostatic field, which is proportional to the potential, by means of a sensitive vacuum tube amplifier. A revolving grounded shutter is employed to alternately shield and expose a terminal connected to the input of the amplifier. The deflection of a meter in the output circuit will thus be proportional to the strength of the field, and may be calibrated to read the potential of the spheres directly.

Within each sphere a miniature laboratory has been constructed. In these laboratories, investigations will be carried on to learn more about the atom, one of the many purposes for which the generator was built. That high speed electrical particles shall prove themselves an effective weapon in breaking down the atom, is the hope of all these interested in the M. I. T. generator. Whether man will ever be able to harness the tremendous energy that exists in the atom, depends upon how much the physicist can learn about the atom.

A Brief Discussion of the Gas Turbine

By Gerald E. Kron, 'm grad.

THE turbine, in its most simple form, is one of the most elementary of all types of heat engines. The turbines of Hero and Branca are classical examples of this statement, in that they were among the first heat engines ever invented and were actually used, in some form or other, long before the advent of the reciprocating engine. When the latter engine was introduced in the form of a steam engine, the turbine was almost forgotten for about sixty years. In a comparatively short time, but with very rapid and intensive development, it has completely supplanted and rendered obsolete the larger sizes of reciprocating steam engines. After the introduction of the reciprocating steam engine the internal combustion engine was conceived and developed. Under the influence of the steam engine, the internal combustion engine developed directly into a reciprocating machine. The first internal combustion turbine was not patented until 1873, which shows that the idea had not taken hold until fairly modern times.



—Courtesy McGraw-Hill

The First Gas Turbine Constructed in France by Arinengaud and Lemale in 1905.

The general principle of operation of the gas turbine is the same as that of the steam turbine, except that working fluid is different. Instead of using steam, it makes use of a mixture of gases resulting from the combustion of a liquid fuel with air. Air and a quantity of fuel are introduced into a combustion chamber. When the fuel burns, heat is generated, and expansion of the air, and the products of combustion takes place. Thus the energy increase of the gases enables more work to be done than was expended in compression. This type of machine in which the combustion is continuous, is termed the constant pressure type. In the constant volume type, a series of explosions occur in the combustion chamber, combustion taking place so rapidly that the pressure becomes very great before an appreciable amount of the gases can escape from the nozzle. After combustion, the gases expand through a conventional nozzle into the buckets of an impulse turbine wheel. The impulse wheel has been considered the most suitable for the gas turbine since a reaction wheel would be exposed to the very high temperatures of combustion before any expansion process. Theoretically, the efficiencies of the constant volume and constant pressure turbines should be equal. The details of this discussion will be confined to the constant pressure type of machine, though, in general, it will apply to the constant volume type.

The constant pressure type operates on the Brayton cycle. Air for combustion is compressed in the combustion chamber, until a pressure is reached at which combustion occurs. The hot gases resulting from the increase in volume and temperature then expand adiabatically through a nozzle of the common De Laval type which completes the Brayton cycle. The gases now cool at constant pressure. The work available to the turbine will be the difference between the heat added to the working fluid during combustion and that lost by the gases to the atmosphere after expansion. The net work delivered by the compressor turbine assembly will be this quantity multiplied by the efficiency of the turbine and combustion chamber minus the work to compress the air. The net thermal efficiency of the whole assembly will be this net work divided by the heat input from combustion. In the form of an equation this expression is:

$$e = \frac{\left[(Q_1 - Q_2)\,y - \frac{W_c}{x}\right]}{Q_1}$$

[1]Where: e = net thermal eff.
Q_1 = heat input
Q_2 = heat lost after expansion
y = eff. of wheel and combustion chamber
x = eff. of air compressor
W_c = theor. work to compress air

This equation discloses the fact that one of the greatest weaknesses lies in the air compressor. It is readily seen from the equation that, if the fraction W_c/x is equal to or greater than the quantity $(Q_1 - Q_2)\,y$, the turbine will not run, because it will take as much or more power to operate the compressor than the turbine can deliver. This has actually been the case in many of the models which were equipped with air compressors of low efficiency.

[1]Moyer, Steam Turbines, Pg. 520.

The gas turbine assembly may be divided into three main divisions: the combustion chamber, the turbine proper, and the air compressor. Of the three, the air compressor is most in need of improvement and development.

In the combustion chamber of the gas turbine, which corresponds to the clearance space above the piston of an internal combustion engine, the fuel combines with air and burns, liberating the energy that drives the turbine wheel. At one end of the combustion chamber is the fuel nozzle and air orifice and at the other end is the turbine nozzle. In existing types, the air is usually introduced through an annular shaped opening around the fuel jet. The fuel, in the form of a spray, is injected with a pressure of about fifty lbs. per sq. in. more than the pressure existing in the chamber, so that combustion will occur evenly and continuously.[2] Present materials do not make it possible to build chambers and turbine wheels that will stand the high temperatures resulting from combustion of the fuel with the theoretical amount of air. The only alternative is to cool the gases by feeding a large excess of air along with the air for combustion. This air will absorb some of the heat, and the temperature will not rise to such a high value. Approximately 500% of excess air would be necessary to keep the temperature as low as 2000° F, assuming adiabatic compression and no cooling of the air before introduction into the chamber. Under perfect isothermal compression — the air being injected at room temperature — about 270% excess air would be required. This would greatly increase the size of the air compressor. Cooling by injecting water into the combustion chamber does away with the necessity of a large air compressor, and this injection may be accomplished with very little work. In the combustion chamber it will absorb a large amount of heat when being changed to steam, thus acting as a very effective cooling agent — indeed, too effective, for a large amount of the heat absorbed will not be recoverable in the blades of the turbine wheel, with th result that the thermal efficiency of the whole unit will suffer considerably. A gas turbine cooled in this way becomes very nearly a steam turbine in which the steam is generated by the direct contact of the water with the burning fuel. It has the further disadvantage that the cooling caused by the expansion through the nozzle will be less, because the pressure in the combustion chamber will be composed of the partial pressures of the steam and the products of combustion. The pressure drop through the nozzle will then be only from the partial pressure instead of from the full combustion chamber pressure. A smaller pressure drop will lessen the cooling effect of the expansion, and the gases will impinge on the turbine buckets at a higher temperature than they would if no water vapor were present.

Even with a method for cooling the gases of combustion, the temperature is still too high for an ordinary metal container. For this reason, the combustion chambers are usually lined with a refractory substance, such as a layer of soft asbestos placed just inside the walls of the chamber and covered with a thickness of carborundum. The carborundum will stand very high temperatures and the abrasive action of the gases very well, but it is very hard and brittle. The asbestos forms a soft bed of material between the carborundum and the metal walls, thereby doing away with the effects of the unequal expansion between the walls and the carborundum. Water jacketing is also used very extensively, especially around the nozzle. It has always been found necessary to cool the nozzle in this way because of the large amount of gases that come in contact with it compared to its small radiating surface.

Combustion in the constant pressure type of machine is accomplished by ignition with a spark plug. The high voltage for the spark plug must be left on for a while when starting until the chamber is thoroughly warmed. The ignition may then be turned off and need not be used until the machine is started again. Thus, a gas turbine has practically no ignition troubles at all. This is obviously a welcome advantage. The impluse wheel of the gas turbine is very similar to that of the steam turbine. Wheels with one row and with two rows of blades have been used with success; it is preferable to use a single row of blades in order to cut down the blade loses. This requires that the wheel reach very high speeds; especially if the initial pressure is high, because a turbine has its maximum efficiency when the peripheral velocity of the wheel is one-half the linear velocity of the medium issuing from the nozzle. Wheels of the De Laval type designed for uniform strength are the best suited and have been used to a great extent in the work done abroad. They must stand not only the great centrifugal stresses at high speeds, but the temperatures of the gases (at least 600° F) as well.

Many unusual wheels have been devised, but the only one that has had any success at all is one which has a pair of wheels running in opposite directions. The velocity was staged by letting the gases impinge first upon a conventional wheel, and then upon another wheel in motion in the opposite direction, instead of the usual row of stationary blades and another row of moving blades on the same wheel. This type of wheel has been used in torpedoes which require a double drive for the two propellors, and to which, incidently, the gas turbine is admirably suited, because an abundant supply of compressed air is on hand. The two wheels in this type of turbine must be geared together, and the work done by the second wheel will be only one-third of that done by the first.[3] This double-wheeled turbine arrangement is a rather clever way to get two velocity stages with only two rows of blades. However, it must be kept in mind that a gearing loss has been introduced in place of the loss which has been eliminated in the stationary blades.

The single stage high speed wheel seems to give some promise for the success of units small enough to be used for automotive purposes. The efficiency of these wheels, when run at a peripheral velocity of half that of the gas, is encouragingly high. The drawback (which seems to be always at hand when an idea is suggested for the gas turbine) is that the speeds are so very high that they become dangerous. An eight-inch wheel would have to

[2]Thesis by Boyle, Montana, and Warren, U. W. 1922.
[3]Peabody, "The Steam Turbine," Pg. 161.

be run at a speed of 60,000 revolutions per minute if a combustion chamber pressure of 200 pounds per square inch absolute were used; this rotative speed corresponds to a peripheral velocity of about 1,200 feet per second, or about as fast as a medium power rifle bullet. It is easy to see that if even a small wheel like this burst at such a speed the pieces would be about as hard to stop as small cannon shot. If a wheel of this type were to be made out of ordinary steels, and designed with a fair safety factor, the result would be a wheel with an absurdly large thickness compared with the diameter. However, if a modern stainless steel alloy with an ultimate strength of around 250,000 lbs per sq. in. is used, a very presentable wheel can be made. Some of the new aluminum alloys, with their great strength, might suggest themselves because of their lightness. Unfortunately these metals lose their strength so rapidly as the temperature is raised.

The lack of a suitable compressor, more than anything else, has delayed the development of the gas turbine. Models have been built that were self-compressing, by making use of the inertia of a moving column of gas, but this method compresses the mixture so slightly that it is hardly better than the non-compressing gas turbine. In some cases the *theoretical* work of compression is over 50% of the output of the turbine wheel. An efficiency of only 60%, which is good for a small compressor, would cause an enormous loss of energy. Thus, before the gas turbine can serve efficiently as a prime mover, a small compressor with a very high efficiency must be developed.

The centrifugal compressor and the various types of rotary compressors are most adaptable for use with the gas turbine becaue of their smoothness of operation and simplicity of construction. The centrifugal compressor has a high efficiency, can be driven direct at the high speed of the turbine rotor, has no valves or other parts to cause trouble, and is smooth and quiet in operation. The high pressures in use with gas turbines necessitate compressors with many stages. Accordingly they are usually quite large, and may be much greater in size than the turbine itself. The efficiencies of existing types of rotary compressors are too low to be considered.

Gas turbines were built upon sound principles as early as 1873 by a man named Stoltze. He called it a "Hot Air" turbine, though it really was a gas turbine operating on the constant pressure principle. Two wheels, one a turbine wheel and the other a centrifugal compressor rotor, were mounted on one shaft. The compressor raised the pressure of air to 40 pounds per square inch, part of this air being used for combustion purposes and the remainder for cooling by being introduced after combustion was complete. Stoltze constructed a turbine developing 200 H. P. on this plan, but he never developed it and the idea was allowed to die. The first attempt to construct a machine on a large scale was made by two French engineers, Arinengaud and Lemale in 1905. Preliminary experiments were performed on a standard 25 H. P. De Laval turbine operating on the constant pressure cycle and using compressed air from the mains of Paris. Later a special Curtis wheel was built, and it was direct connected to a 400 H. P. Rateau compressor which served as a load and furnished air for combustion; that is, any air left over from the output of the compressor after air was extracted for combustion, represented the useful work done by the machine. The adiabatic cooling after the nozzle was not very great because the pressure used was only 71 pounds, so a large amount of cooling by other means was necessary. This was finally accomplished by injecting a very large amount of water after combustion, with the result that the thermal efficiency of the cycle was greatly lowered. The net result was that the final overall thermal efficiency was 3%; the assembly was barely able to run itself. Later the machine was successfully re-designed to be used in a torpedo.

In spite of the difficulties involved in the design and construction of a gas turbine, an economically practical machine working on the constant volume principle has been built by a German named Holzwarth. The combustion chamber of the Holzwarth machine has three valves, one controlling the fuel opening, one the air, and one to close and open the nozzle outlet. With the nozzle valve closed, the air and fuel valves were opened until the chamber was filled with an explosive mixture, whereupon ignition took place and the nozzle valve opened, thus admitting the gas to the turbine wheel through the nozzle. A series of six of these chambers was used on one wheel in order to get the turning effort uniform and get as much power as possible with the single wheel. Several machines, ranging in size from rather small ones up to as large as 5000 Kw., were built to operate on this principle. With the rather low compression pressures first used, thermal efficiencies up to 13% were obtained, and the designer expected to get values up to 25% by increasing the compression and making other improvements.

In spite of the apparent success of this machine, very little has been heard from it, probably because it is still in the experimental state. If work could be resumed upon the gas turbine it seems possible that a commercially successful machine could be produced in a few years. Unfortunately. interest and work seems to have lagged during modern times, and the work that has been published is very meager indeed.

Thales was asked what was very difficult; he said: "To know one's self." — *Laertius*

You'll usually get credit for knowing what you are talking about if you'll just keep your mouth shut.

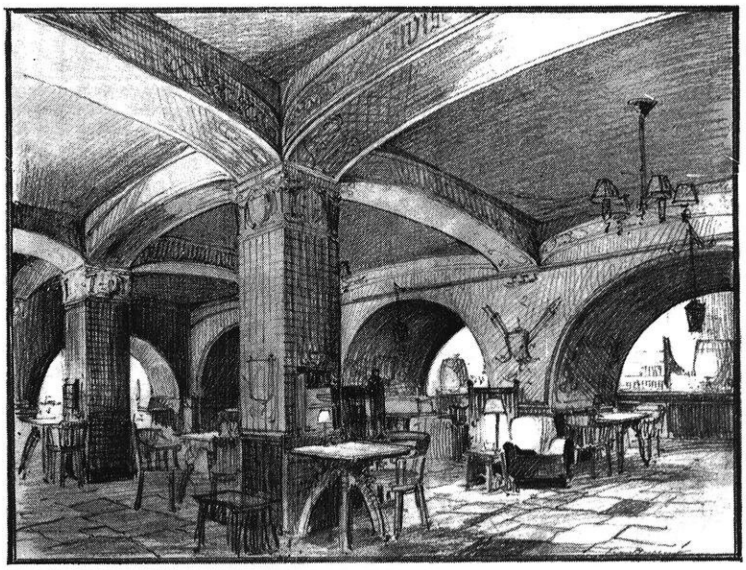
Prosperity is like parking space. There is always plenty for the fellow who gets there first.

It is a strange commentary that the head never begins to swell until the mind stops growing.

Only two classes of people never change; the wisest of wise and the dullest of dull.

The mind of the scholar, if you would have it large and liberal, should come in contact with other minds.

Acoustic Illusion



By C. W. P. Walter, e'34

THE ability of a person to approximately locate the origin of a sound is known to all, but the mechanism with which this location is accomplished is not thoroughly understood. It is believed, however, that the interaction between the two ears has much to do with it. When the head is facing the source of sound, the intensity and phase relation of the sound is about the same at each ear. Upon turning the head, the intensity of sound as well as the phase relation is altered. Stopping up one ear seems to destroy the ability of allocation and gives an effect similar to viewing a scene with only one eye. The lack of perspective is noticeable.

Under special circumstances of reflected waves, sound may appear to come from one point when in reality its origin is elsewhere. If one is seated at a table under one side of the broad arches of the Ratskeller, a conversation under the other side of the arch may be heard quite clearly, in fact the illusion of someone speaking at your table, is created. From the source on one side, some of the sound travels to the arches and is reflected in such a manner that it is focused on the other side. The careful observer may be able to distinguish between the direct wave and the reflected wave by the difference in time that it takes for each to reach his ears.

At the Century of Progress, acoustic illusion was demonstrated telephonically by means of the binaural system. This system consisted of two separate transmitters and receivers of high quality with individual amplifiers for each transmitter and receiver. The transmitters were mounted in the head of a tailor's dummy just in front of the ears. The transmitter in the dummy's right ear was connected to the receiver for the right ear of the observer, and similar for the transmitter in the left ear. This arrangement of the transmitters and receivers duplicates the conditions of normal hearing as nearly as possible, for the observer will hear sounds as he would if his ears were in the same position as the transmitters. It was essential that high quality transmitters, receivers, and amplifiers were used so as to insure fidelity of tone reproduction. Equalizers were further used to correct the frequency characteristic of the system so that the reproduction was exceptionally faithful. When a speaker spoke confidentially in the dummy's ear, "Please move over," a surprisingly large number of observers who were listening, started to obey the command before they realized that it came from the receivers. Speech originating from behind the dummy appeared to the observer to be that of a voice behind him, and as the speaker moved around from left to right, the observer could discern this change in position by the voice heard in the receivers. The reproduction was so faithful that the jingling of keys, tearing of paper, and ticking of a clock sounded quite natural in the receivers.

Experiments have been made in the use of two microphones for picking up the music of orchestras. It has been found that the best place for the microphone was close to the orchestra where the sound is more brilliant and effected to a lesser degree by absorbtion, than at a distance from the orchestra. The same type of binaural system was used with the result that observers found the music far more natural and realistic in quality than if a loud speaker system was used. Most observers stated that the binaural system was to be preferred despite the inconvenience of wearing the head receivers. Even when all frequencies higher than 2800 cycles were suppressed by means of low-pass electrical filters in the binaural circuit, more than a third of the observers preferred it.

Such a demonstration seems to indicate that in order to faithfully reproduce sound, a binaural system should be used. Reproduction at the present time is not perfect because of the non-linear frequency characteristics of the over all electrical systems. It is undoubtedly true that improvement in both receivers and transmitters will bring us nearer to the goal of fidelity in reproduction, but it appears as though this improvement will have to be augmented with the binaural pick-up and distribution of sound in order to make reality possible.

« « EDITORIALS » »

DUE PROCESS OF LAW Governments and the laws they promulgate are for the purpose of promoting the public welfare and protecting the rights of the individual citizen. Each of us has a right to expect that we will be protected and that neither our property nor our lives will be taken from us without due process of law. Whenever we permit an individual or a group of individuals to deal out punishment as has been done in the recent lynchings, your rights and mine are endangered. "Mob law" is no law. It is the antithesis of law and justice.

When a heinous crime has been committed there is great provocation to wreck vengence on the criminal, but a mob does not weigh evidence and may easily execute an innocent man. It was only the intervention of a sheriff which prevented the California mob from taking another prisoner instead of one of those it was seeking. If the law is too slow or its punishments are inadequate the remedy is in changing the law, not in resorting to mob violence. It is the shallow thinking of the Governor of California that has led him to his disgraceful attitude on the subject of lynching. Public welfare and our liberties are best protected by the observance of due process of law.

HISTORY MILL Little thought is given to the general happenings occurring daily all about us and even in our local surroundings important events evince only our passing interest. Relief projects, public works programs, policies relative to gold and silver, war debt controversies, governmental recognition of a world power, repeal of the eighteenth amendment, liquor control legislation, and revolutionary changes in the banking system are but illustrations of a movement which may appear in our history texts ten years from now as an important social and economic revolution. Most of us do not grasp the full import of the change which is taking place. We do not stop to think of the tremendous quantity of executive legislation that has come from the presidential administration within a short ten months.

Contrary to the trends of previous years such things as political parties, and partisan views are conspicuously absent in the American press today. Instead we are quietly observing the movements of an aggressive president. There is not much adverse criticism to his movement. Nor is there, on the other hand, any wave of exuberant hysteria sweeping the nation to give false implications of the actual situation. There may be no more than fifty cents in the United States Treasury today and yet no uproar greets our ears as we read the newspapers. It seems that we ordinarily restless Americans are playing the role of the vicious dog that becomes as meek as a lamb when wounds are being treated. It seems fortunate that the citizens are diligently attempting to carry out the provisions of a president's ultimatum when it is so obvious that his work is being done with integrity and sincerity of purpose.

No matter what may come in the future it is evident that we are passing through a tremendous readjustment at the present time and the bearings in the national *history mill* are running hot, even though we may not realize it until we read our children's history books some day.

THE FEBRUARY ISSUE —

The February number of the *Wisconsin Engineer* will contain a story of an interesting trip through the refinery of the Tidewater Oil Company located at Bayonne, New Jersey. This company has one of the largest vacuum distillation units in the world. The writer, L. G. Janett, ch'35, inspected the plant during a six-week stay in New York during the past summer.

Music is the mediator between the spiritual and the sensual life. Although the spirit is not master of that which it creates through music yet it is blessed in this creation, which, like every creation of art is mightier than the artist. — *Beethoven.*

The first step to knowledge is to know that we are ignorant. — *Cecil.*

Four Years -- Five Years

An Editorial

A CREDIT is a unit standardized by the university. It is true that engineers carry one of the heaviest schedules in the university and therefore it is the purpose of this editorial to attempt to give a few observations concerning four and five year courses.

Impartial analysis of a situation is an elusive achievement which can be approximated only to the extent of disinterest evinced by the analyst. In the matter of curricula for engineering colleges it is easily possible for one to take a stand in favor of either a four or five year course of study with logical and substantial justification in either case. However, instead of advancing only one side of the situation to prove a point, it seems proper to approach the subject with both viewpoints, pro and con, and to weigh factors carefully before passing judgment.

It is undisputed that a five year course in engineering would give a student an opportunity to more fully complete his cultural and non-technical training in order that he might more completely humanize his after-college life. This obvious aspect, which is so evident to students, overshadows another important condition which the five year program would alleviate.

> *L & S: "How many credits next semester, Bill?"*
>
> *Engineer: "I'm taking twenty, including a couple of electives."*
>
> *L & S: "Gee, that's a heavy program, but I suppose you have quite a few labs. - - -"*

Under the present plan the faculties of departments are much in the position best illustrated by analogy. They, of necessity, must crowd into the twenty-four hour day of the student the absolute maximum allowable unit of work in order that graduation requirements might be met Admittedly, these requirements dare not be lowered. Since each department zealously endeavors to uphold its own high standard of thoroughness and efficiency, a *tension* aligns itself between faculty departments within the college, each element maintaining that the other professor is taking more of the students' time than is his due share. The condition results in not only saturating a student's mind but of adding as much superheat as the fellow's capacity permits. Unfortunately the maximum super-knowledge that an average tudent can retain is difficult to determine from the grade book. No one knows how much of the knowledge disseminated by the instructor leaves the student in the same manner that water rolls from a duck's back. Though most instructors do their level best and most students direct their efforts to good advantage, both factions are somewhat disappointed, the former because of unsatisfactory grade book yields, the latter because of their injured pride, resulting from the fact that they have not satisfied themselves in mastering what has been offered them. Tension in education, then, certainly does not make for satisfactory results. A five year course would primarily reduce this existing tension and would tend to prevent that development of a most cordial hate toward subjects, due to one's inability to virtually 'swallow it all'. Cultural education would receive its proper recognition and needs no further discussion here.

Confronting the adoption of a five year system are factors of a conservative nature which are still holding the stage today. Financial considerations are of utmost importance.

The added cost of attending college an additional year would undoubtedly lead to reduced enrollment in the engineering courses in any particular university if four and even three year courses were available elsewhere. Further, it is true that engineering colleges are still the competitors of the practical methods of engineering education and training. A college education has not yet become the criterion for a man's becoming a member of the profession. Public trends toward raising standards, however, should be observed by college administrations with the view of enacting corresponding curriculum adjustment. At present over twenty-four states have provisions for licensing engineers upon submitting evidence of professional ability. The American Association of Engineers is also undertaking action to elevate ethics and standards.

Since a five year course is fundamentally and professionally sound in principle the point of practicability is the governing factor. It is clear, then, that when public opinion and professional standing are favorable and when economic strain is alleviated, the time will be at hand for lengthening the course of study. That time may not be far off if the optomistic atmosphere of today is justified.

Pioneering will mean some temporary set-backs. Enrollment may decrease and yet high-caliber educators must be paid. Instructors must eat. Equipment must be purchased. To adhere to such a progressive course will call upon some genuine Wisconsin spirit, the lack of which is so deplorably portrayed, rightfully or wrongfully, by some alumni at their football-season banquets each fall. Years from now may there exist a phrase that might be termed a national tradition—"*Wisconsin—Pioneer in Engineering Education.*"

—*L. G. J.*

« CAMPUS NOTES »

UNIVERSITY ARBORETUM TAKES SHAPE

The University of Wisconsin Arboretum and wild life Refuge on the south shore of Lake Wingra is gradually assuming definite form. The land was acquired last year by the University, and the work has progressed since then. The topographical engineering students, under the direction of Professor Ray Owen and Frank Matthias, made reasonably accurate topographic maps of the area, and also did much of their leveling and stadia work on the area last spring. According to Professor Owen, the various student maps of the area checked each other quite accurately, and, after being assembled and matched, presented a more accurate map of the area than any possessed by Madison engineers.

The three springs in the arboretum have been beautified with the aid of Madison sandstone retaining walls. The entire area is to be landscaped under the direction of the University. The Pinetum, which will eventually contain a collection of pines and conifers from all over the world, was started by a donation to the University of 100 large size evergreens and several hundred shrubs. The evergreens are now being transplanted to the Pinetum under the direction of Professor G. William Longenecker of the horticulture department.

PROFESSOR JANDA IS GUEST SPEAKER AT SIGMA PHI SIGMA BANQUET

Mr. H. F. Janda, professor of Highway Engineering and City Planning spoke on "Jewels" at the recent banquet and smoker of Sigma Phi Sigma fraternity. Professor Janda has made jewels his hobby, and, in the course of his studies of gems, he has come to know a good deal more about their characteristics than the average jeweler. It may seem a bit unusual that a professor of engineering should choose a subject so foreign to engineering for his hobby. Such a choice is, however, a compliment to the versatility of our faculty.

ENGINEERS TOOT THEIR OWN HORNS

Sinfonia, the University men's musical group, recently initiated 14 new members into the fraternity. Of the fourteen, two, or 14.3%, were engineers. The engineers initiated are: Howard Kumlin, '36, and Maurice Jansky, '35.

We offer the above percentage, and others of a like nature which have appeared in recent issues of the *Wisconsin Engineer* as evidence contrary to the popular belief that the engineers are tied solely to their engineering. If anything, the engineers are doing more than their share of participation in extra-curricular campus activities.

ENGINEER LEADS MILWAUKEE HARVEST BALL

We wish to correct the current popular impression that Bob Engelhardt, c'34, was "Prom Queen" at the annual Harvest Ball held in the Milwaukee Auditorium. As a matter of record, he was chosen by the Queen of the Ball, Miss Ruth Jung, student at the Milwaukee State Teacher's College, as King for the evening. In this capacity, he spent a rather warm evening tagging along after the Queen.

ENGINEERS PARTICIPATE IN SKI MEET

Three members of the Hoofers club placed in the ski tournament held at Oconomowoc on Sunday, January 7. Lloyd C. Ellingson, law 2, took fifth Class A with two jumps of 95 and 96 feet respectively. Eric Sollid, c'33, took fifth Class B with two jumps of 87 and 86 feet respectively. Edmund (Torchy) Couch, c'34, made two jumps of 79 and 92 feet respectively, but was barred from placing because he inadverdently sat down after landing from one of the jumps. It is rumored that one of the red headed gals in the audience might have caused Ed to lose his balance.

Ed Couch is in charge of the arrangements and plans which the Hoofers are making for a National Ski Meet to be held soon.

WISCONSIN C. W. A DIRECTOR SPEAKS AT TAU BETA PI INITIATION BANQUET

Mr. Robert C. Johnson, Civil Works Administrator for Wisconsin, explained the nature of his present office at the fall initiation banquet of Tau Beta Pi. The banquet was held in the Memorial Union on Thursday evening, Dec. 14.

Mr. L. J. Markwardt of the Forest Products Laboratory presided over the banquet as Toastmaster. The Welcome to the Initiates was extended by John Brennan, m'4, President of the Wisconsin chapter of Tau Beta Pi, and the response for the initiates was given by Harold Trester, c'4.

Mr. Johnson stated that the C.W.A. project, which was designed to relieve conditions extant in the states which would be hardest hit by cold weather this winter, was conceived here in Madison. It was presented to President Roosevelt and was immediately accepted. As a result of its conception in Wisconsin, the State of Wisconsin had an organized staff by the time money was appropriated for the project, which enabled Wisconsin to place over 30,000 men to work by the end of the first week. During this period, the other states, taken by surprise, were still organizing their staffs.

When the Wisconsin organization was first formed, Professor M. O. Withey, of the Mechanics Department, was given the job of upholding the University's interests in the matter. The projects on the campus are being carried out, therefore, due to Profesor Withey's efforts.

Mr. Johnson, a former contractor, is a graduate of the college of engineering. His father was dean of the college until 1902.

Twenty-two men were initiated into Tau Beta Pi. The men initiated are:

Seniors

August O. Bartel, e'34
George J. Burkhardt, m'34
Charles O. Clark, c'34
Richard F. Dittman, c'34
Lloyd S. Dysland, c'34
Orville C. Frank, m'34
John H. Hinman, e'34
Herman F. Hoerig, ch'34
Edward J. Hopkins, e'34
Ernst H. Krause, e'34
Luverne F. Lausche, m'34
Winfred C. Lefevre, c'34
Abraham M. Max, ch'34
Warren D. Mischler, e'34
Salvadore A. Mollica, m'34
Wayne K. Neill, ch'34
Joseph J. Peot, m'34
Gilbert C. Quast, m'34
Robert M. Rood, m'34
Robert A. Schiller, c'34
Harold C. Trester, c'34

Juniors

William J. VanRyzin, m'34

320 ENGINEERS MAKE SURVEY OF STATE UNDER DIRECTION OF OWEN

Under the direction of Ray S. Owen, professor of topographic engineering, field work has been started by civil engineers and surveyors in Wisconsin for the purpose of extending the present network of triangulation belts and level lines of the geodetic control survey of the United States.

The work is being done with an appropriation of $42,616 alloted to the project by the state civil works administration. Prof. Owen is the Wisconsin representative of the U. S. Coast and Geodetic survey, and has charge of field work in Wisconsin.

Local C. W. A. units throughout the state are cooperating in the establishment of concrete monuments for traverse stations. The surveys to be made are for the information of county surveyors, city engineers, topographical engineers, and others, as to the elevation above sea-level, the exact location of control points and the exact position of true north. The present work is so planned that ultimately no point in the state will be more than five miles from monuments giving this information.

The benefits of this project, both to the public at large and to engineers engaged in private projects, are easily apparent. This project has long been advocated by the engineering faculty, but like the plan of licensing engineers, it was bitterly opposed by individual private surveyors who made their living by performing land surveys with the aid of their private records and experience.

CIVIL WINS RECOGNITION

Richard Dittman, c'34, gets the medal this month. On December 11, in Steam and Gas lab Dick placed a handy thumbtack on his partner's chair and waited for the partner, Carl W. Moebius, c'35, to park his chassis in the chair. The only thing wrong with the idea was that Dick forgot about it and sat on it himself a few minutes later.

U. W. ENGINEER SOLVES BROADCAST PROBLEM OF RADIO STATIONS

Wisconsin has again contributed to the development of radio broadcasting. In 1917, her engineers put on the air the first telephonic broadcast of music ever heard. Since then the state has pioneered in the use of radio for educational purposes. Wisconsin still operates the world's first educational broadcasting station.

A novel pickup arrangement was designed by means of which station WLBL, the Department of Agriculture and Markets' station at Stevens Point, can bring to its listeners certain educational programs broadcast over WHA. Mr. G. H. Brown, University of Wisconsin Radio Engineer, installed a ground antenna system embodying an aerial more than 1,000 ft. long in the country near the WLBL transmitter. WHA signals are picked up with this apparatus and rebroadcast over WLBL. Other Wisconsin stations, cheered by the possibilities of the plan, have installed such systems and have been given permission to re-broadcast features originating in the studios of the state stations.

OLD MINING BUILDING TO BE REMODELED FOR WHA

An appropriation of $2,700 from capital funds for the purchase of materials with which to remodel the old mining laboratory into a radio station for WHA was approved by the executive committee of the board of regents at its recent meeting.

Actual work on the project will be paid for with funds furnished by the federal government's civil works administration as a means of providing building jobs.

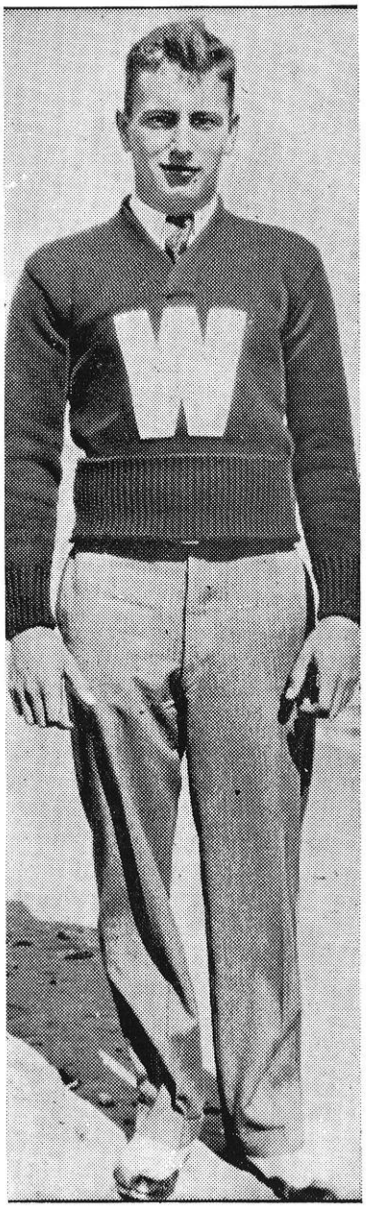
CAMPUS GETS NEW ROAD

Work has been started on a new road around Observatory Hill. The new road, which will practically replace the present route to the top of the hill and around the observatory, is located on the north slope of the hill about 30 feet below the old road. The new road will present to users an uninterrupted view of Lake Mendota and will extend around the hill passing between the Soils Building and the Men's Dormitory Refectory, to connect with the present road leading to the University Dairy. Work on the road is done by hand and is being paid for with C. W. A. funds.

« ALUMNI NOTES »

EDWARD BUTLER SCHULTZ, ex-c'33, was fatally injured in Milwaukee on December 26 when he was crushed between two street cars as they telescoped.

The trolley of the car Schultz had been riding on had jumped the wire several times. As an accommodation to the motorman, Schultz went out of the car to fix the trolley. The following car, evidently out of control, crashed into Schultz and the other car. Caught between the tangled wreckage with one leg almost amputated, and exposed to the added misery of sub zero weather for almost an hour before he could be extricated, Ed Schultz retained consciousness throughout his ordeal and counseled his rescuers as to how they could best effect his release. He died five hours later after one leg had been amputated.



—Courtesy Milw. Journal
EDWARD B. SCHULTZ

Edward Schultz was a state champion swimmer while in high school. He spent two years at the University of Wisconsin Extension Division in Milwaukee and completed his training here with the exception of summer camp and thesis. He had been working on his thesis previous to his death. He was awarded a major letter in swimming last year.

During the summer months Ed was assistant superintendent of the South Shore bathing beach in Milwaukee. After graduation he found it difficult to get a job. However, around the first part of December he got his first engineering job as a civil engineer on Milwaukee park improvements. (CWA).

He was the only child of Mr. and Mrs. Frank Schultz, 1503 S. Fifth St., Milwaukee, Wisconsin.

HELP! HELP!

It is becoming difficult to fill two pages with alumni news every month. So won't you alumni give us a hand and write in about yourself and your former classmates?

CIVILS

ACHKI, FERIDUN, '33, is resident engineer on the construction of 20 kilometers of railroad in the mountains of Kurdistan (Southeastern Turkey) on the Tigris River, 60 kilometers northwest of Dibakir. He has 4 bridges and 13 tunnels on his residency. He can be reached at the following address: Muhemdis Feridun Aski, 26 Inci Kisim, Osmanrye, Dijarbekir, Turkey.

CUMMINS, FRANK J., '30, writes from McKee, Kentucky: "I am working as locating engineer for the U. S. Forest Service and meeting men from universities from all parts of the country.

DERBY, LIEUT. GEORGE W., '33, is on CCC duty in Ranier National Park in Washington. The scenery out there, he writes, is beautiful, but he hopes to come back to the university in the near future.

EGGER, GLENN M., '30, is draftsman for the Denmark Motor Devices and Engineering Co. of Two Rivers, Wis. Residence: 2622 Adams St., Two Rivers, Wis.

GAYTON, OSCAR F., '09, is a special agent for the Mutual Life Insurance of New York. He lives at 124 Illinois Ave., Youngstown, Ohio.

CWA

JOHNSON, ROBERT C., '17, is the CWA director for Wisconsin. Johnson, the son of the first dean of the engineering college, J. B. Johnson, is doing his job with the thoroughness of a real engineer. His total disregard for "red tape" and his thunderous staccato replies to questions is causing the press to call him the Wisconsin counterpart of NRA's General Hugh Johnson.

KENNEDY, FRANK M., '08, has recently been promoted to Lieutenant Colonel in the Air Corps, U. S. Army, and is now in command at Scott Field at Belleville, Ill.

POTTER, W. G., '90, is state drainage engineer of Illinois.

KNOLL, CARL A., '31, entered the employ of the Metropolitan Water District of Southern California on May 2, as recorder on a topographic survey party. He is working on the location of 210 miles of delivery line from the Cajalco reservoir to various cities. He writes: "Since I left Madison, I have kept myself partially busy as a clerk in a market and as messroom boy on a private yacht. I sailed a total of 20,000 miles in connection with various trips which took me to points along the North American coast between Skagway, Alaska, and Acapulca, Mexico. I had two quite interesting years."

LEVIN, J. D., '27, who is on the government engineering forces, will be engaged on construction this winter at Eureka, Montana.

WISNER, JOHN C., '26, was sent to New Orleans last May by the Chain Belt Company of Milwaukee, to get field data on the operation of one of the company's new "pumpcretes," a machine for placing concrete by pumping. The pumpcrete was to be used on the new Huey Long bridge across the Mississippi River. Since leaving school, Wisner was with the Wisconsin Highway Commission for some tme. From April, 1928, to June, 1929, he was foreman and engineer on bridge and paving work for a contractor. From June, 1929, to August, 1932, he was with the Bucyrus-Erie Company at South Milwaukee and at the Evansville, Indiana, plant. At the latter place he was in charge of the engineering department. In September, 1932, he went to work for the Chain Belt Company.

YOUNGSBERG, G. E., '14, is a salesman and service engineer for the Penn-Dixie Cement Corporation. He is married and has four children, two boys and two girls.

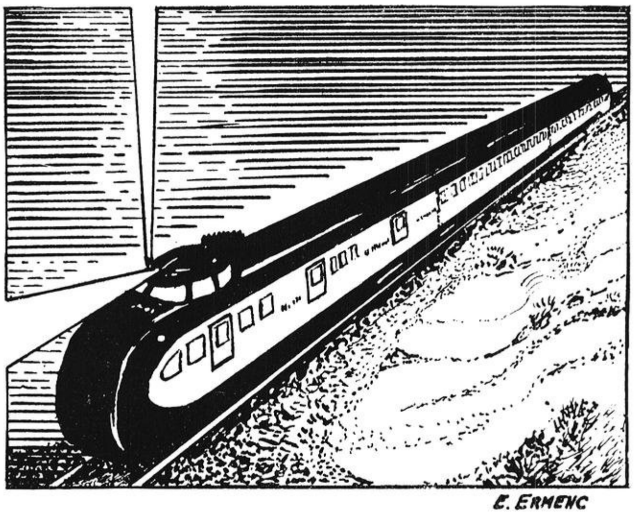
ELECTRICALS

COATES, ROYAL E., '24, is an engineer with the General Electric Co. at Pittsfield, Mass.

CONLEY, BROOKS L., '18, is chief engineer of the Sunlight Electrical Mfg. Co. at Warren, Ohio.

GEYER, ARTHUR N., '10, is an engineer with the Woodward Governor Company. He is living at the Piedmont Hotel in Seattle, Washington.

HELLER, C. A., '99, is budget director of the Commonwealth Edison Company at Chicago. On sending in his subscription to the "Wisconsin Engineer" he wrote: "I note you are having a hard time to pull through this depression. When I was business manager we had a similar struggle and I pulled the "Engineer" out of a hole by securing a number of ads in Chicago."



McWETHY, HAROLD E., '09, is one of the six members of the Associated Consulting Engineers, an engineering clinic equipped to study and handle efficiently and completely any engineering problem and to design engineering works which will function with the maximum efficiency and economy and which will be low in cost and architecturally attractive in appearance. The clinic will have its offices in Minneapolis.

Upon graduation Mr. McWethy worked for the Westinghouse Electric and Manufacturing Company, first at East Pittsburgh and then on electric locomotive development work at New York City. For nine years he was associated with the Wisconsin Railroad Commission as valuation engineer and rate expert. Later he was employed as appraisal expert on the valuation of utilities at Nashville, Tennessee, and Philadelphia. In 1921 he was engaged on the valuation of the Cumberland Tel. and Tel. Company in Mississippi. From 1922 to 1925 he was retained by the Minnesota Railroad & Warehouse Commission as engineering advisor on valuations. Since 1926 he has been consulting engineer with headquarters in Minneapolis, specializing in transportation, valuation, rate and taxation problems.

MECHANICALS

ERBACH, FRED R., '22, chief engineer of the General Refrigerator Company at Beloit, Wisconsin, was recently appointed vice-president and general manager.

GERHARDT, ADELBERT, '21, is an efficiency engineer in Hyde Park, Mass.

HANSON, K. P., '28, is an instructor in the engineering college of the Johns Hopkins University in Baltimore, Md.

HEMMINGWAY, HUGH L., '31, is employed in the laboratory of the Ashland Refining Company, Ashland, Ky. His aldress is Box 466, Catlettsburg, Ky.

JORGENSON, GERALD, '31, is with the Vilter Mfg. Co. in Milwaukee.

McGOURTY, F. J., is engineer for the C. M. St. P. & P. Ry. at Miles City, Montana.

MOORE, LEWIS E., '00, has been recently engaged by the Chelsea Bridge commission to report on several proposed schemes for a new bridge between Charleston (Boston) and Chelsea, Mass. The project involves the expenditure of upwards of a million dollars.

STETSON, GEORGE, '30, M. S.'33, is employed by the Shell Refining Corporation at Wood River, Illinois.

SWEET, CORLISE, '31, M. S.'32, works for the Shell Refining Corporation at Hammond, Indiana.

TAFT, BERNARD E., '31, is with the Vilter Mfg. Company in Milwaukee, Wisconsin.

STIVERS, MAJOR CHARLES P., '13, is in command of Subdistrict No. 1, Texas District CCC, which included thirteen "tree army" camps.

CHEMICALS

de VOS, J. W., '33, is conducting some research work under Professor Ragatz of the metallography department.

IVERSON, JOHN O., '33, is working in the electro-chemistry department under the direction of rofessor aWtts.

RIDGEWAY, LILE C., '27, is assisting Roger Altpeter, ch'grad, in investigating characteristic properties of the combustion of Madison city gas under varying conditions.

EDWARDS, DAVID H., '23, visited the department recently and reported conditions very satisfactory at the du Pont cellophane plant at which he is employed as an engineer. He reported that their equipment was operating at about 75% capacity.

MEYER, ADOLPH F., c'05, C. E.'09, is also a member of the Associated Consulting Engineers. He was engaged in river and harbor work for the U. S. Government from 1905 to 1912 with headquarters in St. Paul. From 1912 to 1914 he was associated with L. P. Wolff, Consulting Engineer of St. Paul on sewage disposal and other municipal work. He was a consulting engineer to the International Joint Commission from 1912 to 1917. He is the author of the "Elements of Hydrology," and from 1913 to 1918 was associate professor of hydraulic engineering at the University of Minnesota. Between 1919 and 1925 he served as consulting engineer to the Commissioner of Drainage and Waters, State of Minnesota, on the Minnesota River and Red Lake River flood prevention and power projects, and as consulting engineer to the Ramsey County engineer on lake maintenance studies. He has been engaged on many other water power and reservoir projects and groundwater studies and has frequently served as expert witness, particularly on cases involving hydraulic problems. He has had considerable construction experience and is the inventor of several machine and instrumests used particularly in the paper industry. He has been president of the Engineers Society of St. Paul and was the first president of the Minnesota Federation of Architectural and Engineering Societies.

Spare Time Laboratory Diversions For Engineers

For Civil Engineers

TRAGEDY NO. 13131313

1. Place a number of ingots of babbitt metal, zinc, lead, etc., in a large crucible.
2. Heat vigorously. When white hot dip fore-finger of right hand into the solution to estimate the temperature — obviating the use of a thermocouple. Withdraw finger slowly.
3. Look the instructor in the eye while testing temperature to show him how you can take it.

Report:

How many months did it take before you could write again and how many fingers have you now? Give your testimonial for Unguentine for minor burns.

For Mechanical Engineers

TRAVERSE NO. 131313 —

Directions:

1. Check out a transit.
2. Do not take the tripod. It is unnecessary.
3. Sight transit at the rod like a telescope.
4. Hold same in the left hand and record observations with the right.
5. Attribute any and all errors to the slide-rule.

Conclusions:

If you were surveying a plot for a pansy bed how many months would it take you? Report the diameter of the cross-hair in your instrument.

For Electrical Engineers

EXPERIMENT 13 —

Procedure:

1. Prepare about one pound of nitrogen tri-iodide.
2. Place in a large mortar.
3. Allow to dry well on a sand bath.
4. Place in far corner of laboratory. Caution!
5. Throw a 1″ teel ball bearing at the mortar from the doorway of the laboratory. Aim carefully.
6. RUN LIKE HELL!

Report:

Show diagram of building before and after the experiment took place. Record the seismograph readings observed at Madison and Chicago. Summarize your interview with the coroner. Record the testimonials of the survivors — if any.

Conclusions:

Submit a tentative budget for a new building for the approval of the regents. Suggest methods of obtaining more accurate data.

For Chemical Engineers

EXPERIMENT 1313 —

PART I

Laboratory Work:

1. Verify the presence of a good head of steam in the supply lines.
2. Adjust governor of the Corliss engine to take care of very heavy loads.
3. Remove belt driving the governor.
4. Open steam valve wide — also the front door.
5. DO A 440 — OVER TO THE FIELD HOUSE.

PART II

1. Never mind part II.

Report:

Measure the dimensions of the holes in the walls of the laboratory. Record your guess of the number of spokes there were in the flywheel. Compute the efficiency of the engine for the museum files.

Conclusions:

Don't you think steam and gas is fun? Would you like to come over and play again some time?

For Mining Engineers

EXPERIMENT NO. — *Last*

1. Obtain a new cadmium standard cell. Record its voltage (three decimal places).
2. Connect a clean copper wire across its terminals. Remove the wire three days later.
3. Use this cell in a potentiometer circuit for your experiment.

Report:

After throwing away the data write all you know about a standard cell. Hand in your paper to the Custodian of the Waste Basket. Please pay for the cadmium cell on your way out.

THE MAREBANKS FORCE DIESEL ENGINE

For Graduate Engineers

EXPERIMENT NO. 1934 —

1. Start the Barebanks Force Diesel Engine by priming the gaskets with banana oil.
2. It is essential that the excitation of the ignition be kept low enough to prevent over-heating from eddy currents. Therefore adjust the excitation to give a leading power factor not greater than the angle between the compression time and the brake arm.
3. After the head has reached the top of the glass, see the instructor and give all reasons for the presence of the large hole in the concrete floor.

THE 23rd PSALM OF AN ENGINEER'S SWEETHEART

Verily I say unto you, marry not an engineer.

For an engineer is a strange being, and is possessed of many evils.

Yea, he speaketh eternally in parables which he calleth formulae,

And he weildeth a big stick which he calleth a slide-rule,

And he hath only one bible, a handbook.

He thinketh only of stresses and strains, and without end of thermodynamics.

He showeth always a serious aspect, and picketh his seat in a car by the springs therein and not by the damsel.

He does not know a waterfall except by its horsepower, nor a sunset except that he must turn on the light, nor a damsel except by her live weight.

Always he carrieth his books with him, and he entertaineth his sweetheart with steam tables.

Verily, though his sweetheart expecteth chocolates when he calleth

She openeth the package but to disclose samples of iron ore.

And he kisseth her only to test the viscosity of her lips.

For in his eyes there shineth a far away look that is neither

Love nor longing — rather a vain attempt to recall a formula.

There is but one way to his heart, and that is Tau Beta Pi, and

When his damsel writeth of love and signeth with crosses, he

Taketh these symbols not for kisses, but rather for unknown quantities.

Even as a boy he pulleth a girl's hair to test its elasticity.

But as a man he discovereth different devices; For he counteth the vibrations of her heartstrings; And he seeketh ever to pursue his scientific investigations even his own hearth flutterings he counteth as a vision of beauty, and enscribeth a formula.

And his marriage is as a simultaneous equation involving two unknowns, and yielding diverse results.

—*The Annapolis Log.*

BEDTIME STORY FOR ENGINEERS

In the valley of the Calculus, close by the river of Arsenic, lived a little slide-rule, by the name of Log-Log. Little Log-Log went out hunting for integrals one day, armed with his trusty double-barreled Lefax. After looking for tracks for a long time, between the limits of zero and raspberry pi, he suddenly came upon a wild integral feeding on a dyne bush. The ferocious integral became enraged at the interruption and charged at poor little Log-Log. As he came thundering through the dense underbrush (density is inversely proportional to the square of the distance from negative infinity) he roared and growled his battle-cry of "Heterodyne your signals to one frequency." Little Log-Log stood ready with his Lefax, and was prepared to use his self-spilling fountain pen in case of a hand to hand struggle. As the charging integral came within ten millimeters of where little Log-Log stood, Log-Log pulled all twenty-seven triggers and fired into the integral's third quadrant. The enormous power of the Lefax which was heavily charged with trigonometric and logarithmic tables, spun the integral about his Y-axis and sent his moment of inertia flying along a sine curve into the fourth dimension. Little Log-Log restored his trusty Lefax to his brief case and oscillated along the path to his home, where his supper of broiled ohms and ionized ampere soup was waiting for him. Now, if you are all good little engineers, maybe Uncle Charles will tell you some more adventures of little Log-Log.

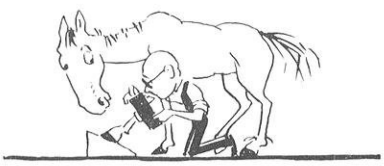
—*Auburn Engineer.*

G-E *Campus News*

CABLE-GRAM

It's not easy to tell you how, for many years, G-E chemists have been fiddling around with Glyptal (a synthetic resin of the alkyd type, made from phthalic anhydride and glycerine as base materials); or how, in studying high-molecular-weight organic compounds, they found that the flexibility of Glyptal could be varied by changing the length of the chains of the polyesters—ho, hum! But you may be interested in knowing that Glyptal compounds make excellent printing rolls, tooth-brush handles, gaskets, ash trays, automobile finishes, and—what not.

These chemists not long ago turned out Glyptal-cloth insulation for cable. Soak it in oil; it won't care. Heat it to 200 degrees F., if you wish. Its resiliency is remarkable; its tenacity, terrific; its durability—it makes other insulations seem like wrapping paper.

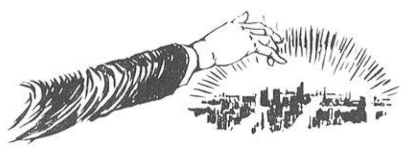


'X-RAY AS YOU GO"

It's just the thing for customs inspectors, veterinarians, baggage men, and detectives—this new portable x-ray announced not long ago by J. H. Clough, U. of Rochester, '16, new president of the G.E. X-Ray Corporation.

The set can be toted around easily, and operates, safely, from an ordinary light socket. It will make x-rays of the human body, industrial fluoroscopic examinations, and radiographs of locked trunks, suspicious packages, and the like. It is particularly adapted to making x-rays of animals and for use in cases where the machine must be moved to the patient. A layman can operate it easily and with safety.

It brings the x-ray within practicable reach of the veterinarian. The first set built was rushed from exhibition at Chicago to Belmont Park, and there used to inspect the right forefoot of one of the best-loved horses of the modern turf, which was on the point of being prematurely retired for a puzzling lameness. So simple and quiet was the operation of the x-ray that the horse was not in the least nervous. "Well, well, boys," neighed Equipoise, "I'm sure glad you came along."



99.9909% PERFECT

Soap that's "99.44 per cent pure" may be pretty good, for soap; but in the matter of reliable control of street lights—well, lend your ears.

Carrier current controls the street lighting in one district of Springfield, Mass. In the last year there have been but 32 failures (from all causes, lightning included) in 350,928 controller operations. That's within .0091 per cent of perfection.

Carrier current makes use of wires and transformers already installed, avoiding duplication and congestion of circuits. In Springfield, a 700-cycle current, transmitted for eight seconds, operates 481 controllers, turns on 675 lights. Used 30 seconds, it turns them off. A second frequency of 460 cycles is available to control off-peak water heaters and other devices. This is the only G-E installation of its kind—a temporary distinction, we hope.

C. E. Jennings, Ohio State, '12; F. M. Rives, U. of Texas, '23; and J. L. Woodworth, U. of Idaho, '24, were responsible for this job.

NRA U.S. WE DO OUR PART

96-27DH

GENERAL ELECTRIC