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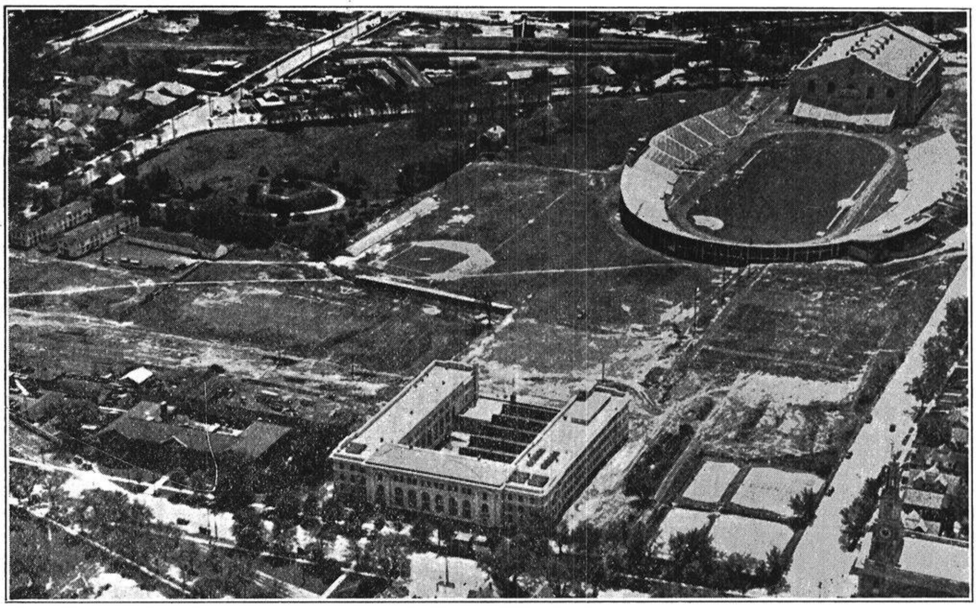
WISCONSIN ENGINEER



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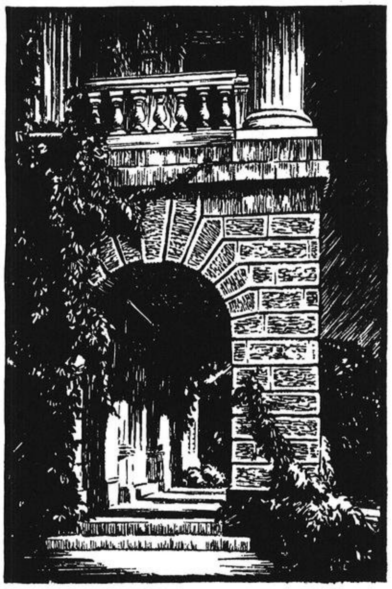

A drybrush drawing of the portals of Bascom Hall, University of Wisconsin at Madison

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THE ARMORY

The WISCONSIN ENGINEER

VOLUME 37, NO. 2 NOVEMBER, 1932

The Flying Windmill

By LESTER D. WOODFORD, I. E. - M. E.

> *This article on the autogiro, more popularly called a flying windmill, was written by an Ohio State student and appeared in THE OHIO STATE ENGINEER. It received first prize as the best student article published last year in the group of engineering magazines which are members of Engineering College Magazines Associated. The award was made at the E. C. M. A. convention held on October 27, 28, and 29. This article is a striking example of what can be done in popularizing strictly technical material.*
>
> — EDITOR.

IF YOU have been close to aeronautical activity during the past year you may have caught a glimpse of an autogiro. If you haven't, just read the Sunday papers. "Flying Windmills" have knocked the bathing beauties off the first page of every rotogravure section in the country.

What a bus! It makes a noise like an airplane, it looks something like an airplane, and for all practical purposes, it is an airplane, but it does things in the great open spaces that would make any airplane in the world turn up its tailskid and hike for home.

It has done things in the air that Al Williams couldn't equal in the best bus in the navy. It has turned tricks that Jimmie Doolittle would have dubbed in the army's safest crate.

Crazy, am I? Not at all. Just seat yourself in the shade of the hangar where you won't be in the way of the grease monkeys and listen to my yarn of this sky-riding gadget that allows us amateur stick-pushers to make monkeys out of the demigods and godlings of aviation.

America first saw the autogiro at the Cleveland Air Races in 1929. It was a bad day for flying with wind and dust and sun. Crowds pressed the edge of the field. Ships leaned their tails in the dirt, while pilots waited for the flag that would send them up to compete in the spot-landing contest. The target was a white circle in the center of the tarmac.

One of those ships looked like a pilot's conception of a nightmare. Below the neck, it was orthodox and regulation. A metal prop, radial engine, and fat airplane fuselage gave it a conventional appearance. Above the neck, well, you've got to use your imagination.

Projecting up over the front cockpit were three four-foot lengths of metal tubing that came together above at a point, pylon-like. On this point rested what appeared to be a four-bladed windmill with fallen arches. Actually! Horny-handed mail pilots took one look and sent mechanics galloping for aspirin. Children ran screaming to their mothers. Women saw it and fainted. That was the way the autogiro looked to them.

But two air-wise men believed in it — Harold Pitcairn, the fellow who brought it to America, and Juan de la Cierva, its inventor and pilot.

Take a look at the latter. Roly-poly, fat-jowled, high-browed, he packed more mathematics in his dome than you can find in a carload of calculating machines.

A Spaniard and a Spanish airplane, to those hard guys at the air races, was about as sensible as a Swiss inventing a battleship. So the hard guys snorted, took off and tried to set their crates down on the white circles. Some came fairly close — oh, about thirty or forty yards. Then the starter beckoned to Cierva. The announcer saw the signal and turned to his loud speaker with a grin. Things were dull and this was the spot for a gag.

"Ladeez and gen'mun," he cracked, "the autogiro will now take off — if it can."

The stands howled.

Cierva hit the gun and the winged nightmare rolled across the field. As it went, the big windmill spun faster and faster, losing the wilted appearance that had distinguished it at rest. The mob gasped and leaned hard against benchbacks.

After a thirty-yard run, the autogiro was off. Off and climbing.

"Holy mackerel, he'll spin it!" gritted a hard guy.

The autogiro climbed on. Cierva knew his plane. Coming back, he cut the gun and floated along. Slower and slower. A light headwind held him back still more. For a minute he hovered almost stationary over the field. Not a syllable was whispered. Any other ship would have crashed. He dropped very slowly, apparently under perfect control. A hundred feet up, he lowered the nose and slid toward the landing circle. Gliding, advancing, he sank until his trucks were six feet off the ground. Stick back, then. The tail came down and the skid jabbed the gravel in the center of the target. She bounced a little and came to rest after a five-foot run. A bull's-eye!

And that was the introduction two years ago of the autogiro in America. Since then it has been redesigned and improved until the present ship is as nice a job as you could ask for.

But first let's get a look at the great engineer, Juan de la Cierva — there is a name for you — who got his start flying gliders when he was a boy, like many of the world's famous aviators. But that didn't satisfy Cierva, so he went to work on an airplane.

In 1918 the Spanish government asked him to build a military bomber. He did, a three-motor bus which flew so well that even the King, who financed it, was satisfied. The pilot who was given the job of pushing her around the sky became overconfident of the ease of handling her and so it happened that one fine day while taking off he tried to lift himself by his own bootstraps, with the usual result. He had to ride "shank's mare" home.

This accident taught Señor Cierva two things: first, that airplanes are fundamentally unstable; and, second, that pilots are liable to make mistakes. So he set to work at designing a ship that would be as safe as the bed you sleep in. In fact, it was proven safer, for people have died in bed but no one as yet has been killed in an autogiro.

No one knows where he got the notion of the flying windmill. Or how he was able to sprinkle salt on its tail and make it work. But he did. In 1922, his first life-size machine was rolled out on a Spanish airdrome and started. It promptly turned over on its side and expired. After a year of trying to figure it out, he repeated the experiment. This new bus shook like a soak with the D. T.'s, threatened to rise, and then died with a long, sweet shudder.

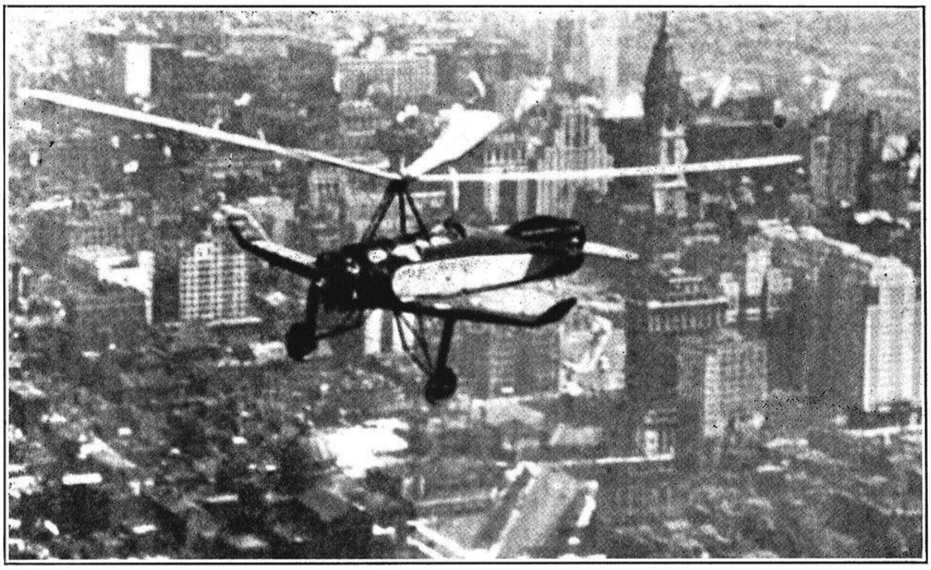
More work, more figures, more pains, and then came the year 1923. Juan de la Cierva sat in his pit and watched the windmill of a redesigned model spin over his head. Five minutes later he was in the air. Success at last.

Or so it seemed until he tried to interest people in his notion. Oh, some of them were half-heartedly enthusiastic, but that was all. Why? Because the world was mad about speed. Wartime crates managed to hit over 120 miles per hour. The autogiro limped along at seventy or eighty top. Government heads told Cierva that his brain child was a good idea from a scientific point of view, but was just so much wet wash as far as they were concerned.

Finally, though, the British government became interested enough to order a couple of machines. That helped matters and furnished materials for more experiments. The ships he built in Britain were a complete success.

Then he met Harold Pitcairn of Philadelphia, and a bargain was sealed that brought the autogiro to the United States. For a while, the old bugaboo hampered them. Speed, speed, speed! Fliers demanded it. So Pitcairn engineering forces went to work under Cierva's direction. Gradually wrinkles were ironed out; gradually experimental models became faster.

Let's take a look at her dimensions. Height, fourteen feet; span of rotor, forty-eight feet; width of rotor blades at tips, two feet; length, twenty-four feet and six inches; weight, loaded, 2850 pounds; pay load, 600 pounds; span of stub wing at bottom of fuselage, fourteen feet.



An Unusual View Showing a "Flying Windmill" Hovering Over the Skyscrapers

Nothing sensational about those figures, but listen to this: climb, 1700 feet per minute; take-off speed, twenty-five m.p.h.; landing speed, zero; slow flying speed without loss of altitude, twenty-two m.p.h. There is spectacular stuff. Quick take-off and slow landing speeds. The best aeronautical brains have been trying to accomplish it for years.

More figures: service ceiling, 17,000 feet; absolute ceiling 20,000 feet; motor, Wright J6-300 h.p.; gas capacity, 39 gallons; range 300 miles. Angle of climb, twenty degrees at thirty-five miles per hour. High speed 120-125 m.p.h.; cruising speed, 95-100 m.p.h.

There's no kick in measuring a bus on the ground, so let's hop her. You ride the front pit and I'll take the rear. Together, we'll take her up and I'll give you a few minutes of dual.

All set? We're ready to go. I pull back the lever that meshes the gears between engine and rotor, slowly at first because the rotor vanes are fairly heavy and a sudden jerk will strip the clutch. It turns, like a huge electric fan to which the current is just applied. Fine! The gears are engaged and I lock the lever back.

Now to accelerate the rotor to flying speed. On the instrument board is a table for the pilot's guidance, figures in r.p.m. are given for each tachometer. With left hand on the throttle, we read those figures. The engine picks up as it gets a little gas. The rotor tach trembles and its needle slides gradually around the dial.

Finally, when the engine is turning about 1400, the rotor tach hits 100 r.p.m. Looking up, we see the four blades cutting the air in a gleaming disc. Through the motor thunder rips the thin swish of airfoils. Instead of drooping as they did a moment ago, each blade now stands out with the ends a trifle above center. At this point it should be understood that they are not rigidly attached to the rotor hub. Instead, hinges form the connection and thereby give the whole structure a flexibility that, say engineers, is the secret of its strength.

The rotor is turning at the desired speed. We are ready to take off, but our tail is facing the wind. Swiftly, we do three things at once: one, release the rotor clutch and push the lever forward until the gear is entirely disengaged; two, shove the throttle to full speed; three, release one foot brake and kick the rudder toward the locked wheel.

The bus pivots as prop blast blows her tail around. Now her nose is in the wind. Quick! Release the other brake and let her roll.

The motor thunders full out. The rotor swishes about at 100 to 120 r.p.m. Forward stick digs the tailskid out of the turf. It is just like an airplane take-off. The only difference is the fan overhead. One wants to duck at first, but that feeling wears off.

We're galloping now! Ten yards, twenty yards, thirty — I haul back on the stick. Wheels spurn the soil and we are off — after a thirty-yard run!

What a climb. The nose streaks up and the big windmill tilts. An inclinometer is fastened to the side of your cockpit. Keep an eye on it. It tells an amazing story. More back stick. The steel ball in the inclinometer tube rolls to the ten-degree mark. That angle would stall most ships. It hits the fifteen-degree notch, and a look overside shows the earth dropping away like a lost world. But that isn't the end. More back stick lifts the nose again. Watch the little steel ball. Eighteen, nineteen, twenty degrees! That inclination would stall any commercial, army, or navy job in America. The autogiro climbs on.

We level off at 2000 feet and ease up the throttle. The flying field drops behind and we wing over open country. A speed test doesn't interest us; any airplane will go fast. We are exploring this one's capacity to do things that the ordinary ship cannot do. Slow flight, for instance.

We can imagine that a fog is shutting down on us. Fog is one element a pilot cannot conquer. Yes, given a radio compass, sonic altimeters, and $10,000 worth of blind flying instruments and equipment, he can take his transport plane through thick weather, but just now we are ordinary air tramps who are flying for the fun of it. We have good instruments but nothing special. Seeing that fog, sane birdmen would hunt a nest. But we can jog merrily along, with no more danger than would be encountered by a motorist who rides into the night.

Slow flight! Dream of the ages. Goal of every aeronautical engineer!

Get a good grip on your seat. We are going to fly backwards, tail first. Yup, the autogiro does that, too.

Here is how! We come across the field at about 2000 feet elevation. The wind is blowing fairly fresh making it a good spot for a demonstration. I cut the gun and lift the nose of the ship as the prop blast vanishes. For a long moment, the only sound is the swishing of the rotor blades. We sight along the edge of an aileron at the earth and notice that we are moving toward the opposite side of the field. But as we look, our forward speed stops and we begin to back up! Yes sir, we are doing just that; flying backwards in relation to the earth. You will also notice that all controls have the same customary feeling as when we were flying at 125 m.p.h.

It seems incredible but the whole secret lies in the action of the rotor. Fanning constantly, it produces a downward wash vigorous enough to give the control surfaces a grip on the air regardless of the ship's position or forward speed.

Of course we lose height — but very slowly. Backward, wind-driven, we recross the field. Giving it the gun we climb through a fast dash, and cut it again. That is one thing that an ordinary airplane won't do.

Let us clear up one point right now. Does the rotor turn when the motor is dead? It does! It turns for the same reason that a windmill turns in the breeze. It turns every moment the ship is in the air for the reason that the least movement creates the breeze to drive its blades. After it is set in motion on the ground, with both wheels locked as before described, it is not connected to the motor. From take-off to set-down, it spins of its own free will.

The ship will land in any place that is large enough to hold it in perfect condition, and without any more jar than a Ford running across a street-car track at twenty miles per hour.

Now notice how we land. As we again arrive over the field I cut the gun and hold the nose down just enough to keep the wind from pushing us backward and we settle down at only fourteen feet per second. A slight jar tells us that we have landed.

"How about this ship for the average man?" people are asking. "Is it one that a dub can fly and live afterwards?"

Right now, as you read this, important brains are asking themselves that very question. The autogiro has tossed a monkey wrench into the wheels of a lot of aero concerns.

No autogiro will ever replace the fast pursuit ship that breezes along at 250 m.p.h. But for the business man who wants speed with safety, the autogiro is the ship. It will

(Continued on page 25)

The State Architect Discusses

The Proposed Engineering Campus*

At Wisconsin

By ARTHUR PEABODY, F. A. I. A.,
State Architect, Wisconsin

The office of the State Architect has maintained always a close relationship with the College of Engineering of the University on account of the advantage of advice in relation to the buildings of the University designed and constructed during the last twenty-six years.

The first contacts of the architect were with such men as Storm Bull, D. C. Jackson, L. S. Smith and incidentally Burgess, Kowalke, Holden, Mead, and others of later date.

In 1906, when the present incumbent began work, the University consisted of some thirty-seven buildings, among which were those assigned to the College of Engineering. Of these, the main Engineering Building was the only modern structure, dating from 1901. The other buildings, erected in 1887, were the Engineering Shops, the old Chemistry Building, old Heating Station, and spaces in Science Hall. The college was hampered by the lack of facilities and also by the precipitous nature of the ground which affected the practical side of instruction in engineering. One would say that the college was excellent from the instruction angle, but lacking in some other respects. It had been already recognized that considerable readjustments must be made in order to expand and perfect the laboratory facilities of the college.

The first building of the new College of Engineering, though not then recognized as such, was the Central Heating Station of the university, on University Avenue, from which the underground tunnels distribute heat and power to the various buildings. Some seven thousand horsepower is delivered from this building for heat, light, and power purposes. At the time of its erection in 1908, the use of concrete construction had become more or less common, but the main supporting members of the building were designed in steel.

For lighter structures, concrete slab floors were then employed, and, in 1909, the first movable concrete-joist forms in the country were invented by the writer and used on Lathrop Hall, one of the larger buildings of the university. These movable wood forms were employed at the university up to 1915, after which they were superseded by the movable steel forms common today. Concrete construction for buildings developed rapidly and added greatly to permanence and safety of buildings.

A principal project in the architect's office in 1906 was the creation of a general design for the university of the future. This was completed and adopted in 1908.

* This paper was presented as an illustrated address before the Engineering Society of Milwaukee on May 27, 1932.

Previous to that time, the physical aspect of the university had been more or less casual. The intention of the first architect, in 1850 or thereabouts, had been to create a group of five buildings, three of which, University Hall, North Hall and South Hall, were erected during his lifetime.

After 1857 and until 1871, no additions were made to the number of university buildings. At this date, and afterward up to 1906, various buildings were added to the campus. These were designed in the styles prevailing at the time, which varied from middle-west vernacular to the Victorian Gothic, red-brick Romanesque, and brown-stone, round-arched Richardsonian. In this way the university represented a collection of buildings rather than anything approaching unity or harmony in architectural style, color and materials. This was, of course, inevitable considering the rigid and unbreakable requirement then prevailing for architects to design in the style prevalent at the moment. It was a period of small achievements and narrow outlook.

The design of 1908 came at a fortunate moment for the university. The course of events was to bring presently a considerable expansion in all departments. Under this design the several colleges of the university were assigned certain areas; for example, to the college of Letters and Science, the upper campus from Park Street to Charter Street on the west. The College of Agriculture was already established on the area north of University Avenue, from Lorch Street indefinitely to the westward. The newly developed College of Medicine was assigned to an area between Agriculture and Orchard Street. Other departments including athletics, service, student housing and the like were indicated on the design. These commitments of spaces have been somewhat modified during the passage of time, but the general intention of the design has been followed in the main. A further development to the east of Park Street has been studied and will doubtless arrive as circumstances permit. The architectural treatment of the university has been consistent and harmonious. A general policy has been established to preserve and create unity of expression within the broad limits of the Italian Renaissance, which permits sufficient variation in form and detail to cover the several expressions of use and good appearance. In a general way the buildings are of a warm buff color with red tile upon roofs where visible. The texture and color of Madison sandstone as employed upon the early buildings of the university has been followed wherever circumstances have permitted. This has been supplemented in instances by pressed brick of the same buff color, thereby conserving the unity of the campus after the custom in other universities, where, for example, Bedford limestone or grey granite is employed.

The assignment of space for the College of Engineering along University Avenue between the College of Medicine and that of Letters and Science was acknowledged to be small, but convenient to the buildings devoted to Chemistry and Physics, courses intimately connected with the study of Engineering. However, this allotment was not permanent. As an outcome of the World War, a considerable expansion of the College of Medicine took place, and the limits of space assigned had to be increased so that the area intended for Engineering was absorbed, and it became necessary to select some other space for this use.

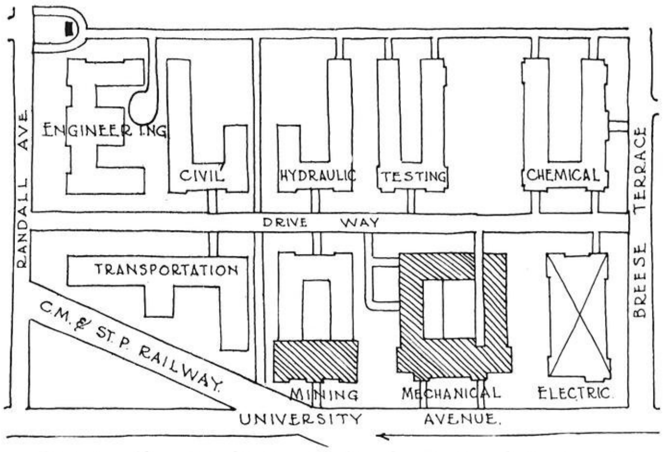
The limitations of the university campus were here brought sharply to attention. There appeared to be but one alternative, which was to assign a location on Camp Randall along the south side of University Avenue. It had been the tradition that Camp Randall would remain always the athletic field of the university. No other use had been found necessary, although the forty acres of the field were obviously in excess of any probable need of the department. A football field occupied a small portion, with temporary bleachers sufficient for the usual attendance at the games, and baseball was played there to some extent. There appeared therefore to be no serious objection to the assignment of a section about 800 feet deep along the north border of the field. This location of the college diminished the athletic areas, but a more serious diminution took place presently when the stadium was erected and the Field House built along the western portion. The increase of student population in this part of town brought about by the construction of dormitory quadrangles along the shore of Lake Mendota, was another disturbing element. Beside this, the advantage of developing athletic areas adjacent to the dormitory quadrangles was so obvious that the advantage of Camp Randall, except for intercollegiate football and basketball games, diminished almost to the vanishing point.

With the assignment of space for the Engineering College a preliminary diagram of the buildings contemplated was prepared. A previous sketch plan was in existence, and already a partial building, housing temporarily the engineering machine shop, forge shop and casting floor, had been erected, to be absorbed later by the Mechanical Engineering Building. The ground plan of the Engineering Campus showed some nine separate buildings with the main Engineering Building facing upon Randall Avenue and assignments upon University Avenue for buildings for Mechanical, Mining, and Electrical Engineering. Adjacent to these were buildings for Transportation, Civil, Hydraulic, and Chemical Engineering and a Materials Testing Laboratory, making in all a series of nine buildings. The exact details of these were left for future study.

At the present time the Mechanical Engineering Building is erected and in service. The former United States Forest Products Laboratory has been assigned to and occupied by Mining Engineering. Studies for the Electrical Engineering Building are in progress and the building is the next on the program for construction.

The question is asked as to how long it will require for other units of the college to develop and when the entire college will be completed. A fair question, barring the rather skeptical tone in which the inquiry is usually made.

In reply one might say that to construct buildings in advance of necessity would be unfortuate anyway and would constitute an obstacle to meeting future needs which, of course, cannot be anticipated at the present time. The project however is no "pipe dream", as has been shown by the similar history of the General Design of 1908, according to which the university has erected some seventy-four buildings or parts thereof; something like twice the number standing in 1906.



Drawing Showing the Layout for the Proposed Engineering Campus. The Shaded Portions are Now in Use.

Of the College of Engineering, aside from those buildings now standing, there is present need for the Electrical Laboratory and particularly for the Main Engineering Building which will unify the college in its new location. The probability is that at least two other buildings will arise within a reasonable time, in order to keep pace with the rapid advance of the science of engineering and its practical application. This would leave space for three others, which is none too much for the probable expansion of the college.

THE ENGINEER

From Bulletin of General Contractors Association, October, 1932.

Since the Lord made the earth in six days, engineers, although paid on the six-day basis, have continued to work seven days and nearly as many nights a week. An engineer can be identified by his trusting look, the resigned expression on his face, and a table of sines and cosines carried near his heart.

Through the ages, the engineer has continued to function, until now our technical schools yearly turn upward of 10,000 young hopefuls on to the American public, each armed with a slide-rule, two handbooks and a bad case of brain fatigue due to four years of unremitting toil. Some of these souls are immediately saved by becoming bond sales-

(Continued on page 31)

« « EDITORIALS » »

ANOTHER POLYGON DANCE The social bug has bitten the engineers again. The sons of St. Pat are going to step in a big way this Friday night at the first of a series of Engineer Hops sponsored by ye good old Polygon.

Engineers are usually accused of being "grinds" and some even go as far as to say that they know nothing and care less about the brilliant social life which is constantly going on here on the campus. Here's a chance to show up these campus playboys. Let's fill up that old Great Hall and make the campus look up to the boys from the "engine works" for putting on a real show.

Every dance Polygon has sponsored up to this time has been a wow and this one promises to be no exception. No other function on the campus can better acomplish the feat of bringing together the men who will work together and who surely want to play together. So get your date and join us at the Memorial Union Friday night. And don't forget that the number of Polygon stag smokers which will be held this year depends on the success of this dance.

MAKE A DIFFERENT NOISE At the E. C. M. A. convention our attention was called by Mr. Howson, Western Editor of *The Railway Age,* to an old slogan in which he sincerely believes. The slogan was: "This world is becoming such a boiler factory that it is only the different noise that can be heard," What truer words could be written? It is in times like these that we really appreciate the value of such advise. For, where is the man who can make good in this day and age without making a different noise? Opportunities are so scarce that it is only the man with a quick mind to grasp at every little straw of hope who really succeeds. There are hundreds of engineers who are making the same kind of a noise and consequently they are in a rut, or are at present out of a job.

How can an engineer who has specialized in one field make a different noise? There are, no doubt, many ways in which this can be accomplished but we will confine ourselves to only one of those methods. This method can be stated in one word — *advertise.* If you know that you have good ideas on a subject or that you have observed something which others are over-looking, write an article and tell the world about it. That constitutes the best kind of advertising. It calls to the attention of the engineering world that here is a certain Mr. Jones who is really thinking and observing things that go on around him.

The problem that then confronts the engineer who resolves to advertise himself is, "Where shall I advertise?" As students here at the university the best outlet for articles of this nature is the student's own magazine: *The Wisconsin Engineer.* An article printed in *The Wisconsin Engineer* not only gives the writer added prestige with the students and faculty on his own campus but gives him an opportunity to come in contact with the numerous influential alumni scattered all over the globe. Thus the pages of this magazine will be serving a double purpose by benefitting the writer as well as the reader, which after all is just as it should be. The student is prone to forget that when he writes an article he is "making a different noise" that will be heard in many places.

THE NEW ENGINEER This month's issue of *The Wisconsin Engineer* marks another milestone in the evolution of an engineering magazine. We have made many radical changes in an attempt to satisfy you, the engineers who read it. Some of you may agree that the changes are making it a better sheet and others may not. At any rate we would appreciate any comments on the "new setup" and would also appreciate any further constructive criticism on the matter.

THE ENGINEER — A PARABLE

By D. B. Steinman

President, National Council State Boards of Engineering Examiners
President, New York State Society of Professional Engineers

One day three men, a Lawyer, a Doctor, and an Engineer, appeared before St. Peter as he stood guarding the Pearly Gates.

The first man to step forward was the Lawyer. With confidence and assurance, he proceeded to deliver an eloquent address which left St. Peter dazed and bewildered. Before the venerable Saint could recover, the Lawyer quickly handed him a writ of mandamus, pushed him aside, and strode through the open Portals.

Next came the Doctor. With impressive, dignified bearing, he introduced himself: "I am Dr. Brown." St. Peter received him cordially. "I feel I know you, Dr. Brown. Many who preceded you said you sent them here. Welcome to our City!"

The Engineer, modest and diffident, had been standing in the background. He now stepped forward. "I am looking for a job," he said. St. Peter wearily shook his head. "I am sorry," he replied; "we have no work for you. If you want a job, you can go to Hell." This response sounded familiar to the Engineer, and made him feel more at home. "Very well," he said, "I have had Hell all my life and I guess I can stand it better than the others." St. Peter was puzzled. "Look here, young man, what are you?" "I am an Engineer," was the reply. "Oh yes," said St. Peter, "Do you belong to the Locomotive Brotherhood?" "No, I am sorry," the Engineer responded apologetically, "I am a different kind of Engineer." "I do not understand," said St. Peter, "what on Earth do you do?" The Engineer recalled a definition and calmly replied: "I apply mathematical principles to the control of natural forces." This sounded meaningless to St. Peter, and his temper got the best of him. "Young man," he said, "you can go to Hell with your mathematical principles and try your hand on some of the natural forces there!" "That suits me," responded the Engineer, "I am always glad to go where there is a tough job to tackle." Whereupon he departed for the Nether Regions.

And it came to pass that strange reports began to reach St. Peter. The Celestial denizens, who had amused themselves in the past by looking down upon the less fortunate creatures in the Inferno, commenced asking for transfers to that other domain. The sounds of agony and suffering were stilled. Many new arrivals after seeing both places, selected the Nether Region for their permanent abode. Puzzled, St. Peter sent messengers to visit Hell and to report back to him. They returned, all excited, and reported to St. Peter:

"That Engineer you sent down there," said the messengers, "has completely transformed the place so you would not know it now. He has harnessed the Fiery Furnaces for light and power. He has cooled the entire place with artificial refrigeration. He has drained the Lakes of Brimstone and has filled the air with cool perfumed breezes. He has flung bridges across the Bottomless Abyss and has bored tunnels through the Obsidian Cliffs. He has created paved streets, gardens, parks and playgrounds, lakes, rivers, and beautiful waterfalls. That Engineer you sent down there has gone through Hell and has made of it a realm of happiness, peace, and industry!"

THE FLYING WINDMILL

(Continued from page 21)

enable him to take off from his own back yard and land on the roof of his office.

When the late Thomas Edison saw this ship land almost vertically at the Newark airport, he threw up his hands and said, "This is the airplane we have been waiting for."

And now for a more technical discussion on why the autogiro flies.

You know that an airfoil set at a certain angle of incidence and moving through air at a certain speed causes a vacuum to form above and a pressure below, which produces on that airfoil a force that we call lift. Take airplane wings, for instance. When moving forty or so miles an hour, they have enough vacuum above and pressure below to lift them off the ground. When their speed drops below the forty or so figure, they fall.

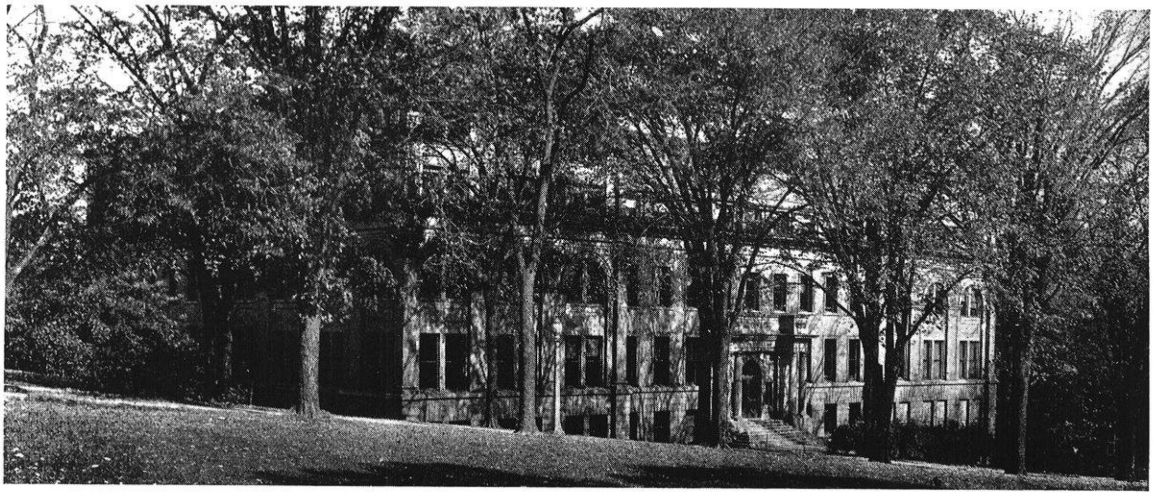
Our windmill, or rotor, consists of four twenty-four foot blades that measure approximately two feet across at the tips; they are wings that revolve about a common center.

Each of these four vanes is an airfoil the same as any airplane wing. When it moves through the air at a certain speed, it acquires this mysterious lift that makes things fly. Now visualize these blades whirling at 100 or 110 r.p.m. That speed plus a twenty-five m.p.h. forward speed, which is acquired as in any other plane by a conventionally mounted engine and prop, is sufficient to give them enough lift to hop the whole ship into the air.

All this lift, which comes chiefly at and near the ends of the revolving blades, one thinks, would cause a great deal of strain on the hub connections. Given a steel tube that is fastened down at one end and raised at the other, one would think the fastened end would tear loose or the tube would crumble. This might occur if it were not for that quantity that engineers call centrifugal force.

When a thing revolves, centrifugal force is produced. Now this windmill of ours whirls at 100 r.p.m., and the force produced is about 5000 pounds. What happens? We have two forces, one lifting the ends of the vanes and the other pulling them apart. The result can be best illustrated by Cierva's own example. Suppose a span of this forty-eight foot windmill is represented by a piece of slack rope held horizontally. In the center it sags just a little, but when a pull is applied, say 500 pounds at each end, the center rises, because of the pull. That is what happens to our autogiro. The revolving vanes seek to straighten, due to centrifugal force, and the center rises, carrying fuselage, engine, and passengers. As the vanes' ends rise still higher because of the lift produced by their movement through the air, Old Man Centrifugal Force continues to keep the rope taut by tugging at the ends. And so the ship soars.

Which all goes to show that this autogiro is far more than a curiosity or a scientific experiment. It is a new type of airplane that will revolutionize the aeronautical industry.



« CAMPUS NOTES »

CIVILS HEAR ABOUT GRADE CROSSINGS

A select group of civil engineers heard of the difficulties of selection, design, and construction of overhead grade crossings from Harry D. Blake, head of the Grade Crossing Department of the Wisconsin Highway Commission, at the monthly meeting of A. S. C. E. held on Wednesday evening, October 12, 1932.

The non-grade crossings built in normal years, said Mr. Blake, are the product of careful study of accident occurence and "primary highway" needs. A definite, State appropriation is to be used by the department to give the best service to the general public. For this reason the "primary highways" are being equipped before some of the by-roads are considered. Also, although considered preposterous by some people, it is often the case that the crossings with no obstructions are the scenes of the most accidents. People are naturally careless at these places so it is up to the engineer to prepare fool proof crossings. However, in abnormal years, such as years of depression, the problem may be varied slightly. The program may be increased and another big item may be considered in the selection of the place of construction. In such times the place where employment is the most needed is given great weight in consideration of the location to be selected.

STAFF MEMBERS ATTEND E.C.M.A. CONVENTION AT IOWA CITY

The *Wisconsin Engineer* was represented at the twelfth annual convention of Engineering College Magazines Associated which was held at the University of Iowa on October 27, 28, and 29 by H. H. Kieckhefer, Editor; R. H. Wood, Business Manager; W. K. Neill, Circulation Manager, and Professor L. F. Van Hagen of the Railway Engineering Department.

Much of the convention time was devoted to round table discussions on the various departments of the engineering magazine. These discussions were held for the purpose of improving the member magazines.

Mr. E. T. Howson, '06, a former editor of the *Wisconsin Engineer,* gave the principal address at the annual banquet on "Technical Journalism."

The *Wisconsin Engineer* magazine was awarded three certificates for superiority in the various departments for the past year. One award was third place for the best editorials, another was third honorable mention for the best alumni section, and the third was third honorable mention for the best student articles.

DAUGHTER OF FIRST EDITOR OF "ENGINEER" IS CIVIL ENGINEERING STUDENT

Thirty-seven years ago the *Wisconsin Engineer* made its first appearance on the campus. At that time its editor was Mr. Edward Bebb. At the present time, Miss Louise Bebb, a daughter of the first editor, is about to graduate from the civil engineering course.

Although Miss Bebb is not on the staff of the *Engineer,* she is vitally interested in the engineering profession and quite emphatically predicts that her younger brother will likewise deign to invade the realm of slide-rules, T-squares, and Steam and Gas reports upon his matriculation in college.

The Bebb family lives in Chevy Chase, Maryland, where Mr. Edward Bebb, '96, is affiliated with the Federal Power Commission as an engineer.

PI TAU SIGMA INITIATES

Pi Tau Sigma, honorary mechanical engineering fraternity, announces the election and initiation of the following men: S. C. Anderson, '33; H. D. Bruhn, '33; J. E. Brennan, '34; O. C. Frank, '34; E. P. Hanson, '33; J. Ermenc, '34; H. L. Mohn, '34; B. P. Hnath, '33; B. J. Schmid, '33; C. K. Otis, '33.

ELECTRICAL ENGINEERS NOTICE

One certain afternoon after a certain night before, Professor Watson discovered a *bona fide* scientist in his EE 2 computation section. After a half hour of prodigious labor, William J. (Say-It-Isn't-So) Walsh, e'34, reported a result representing the flux density through a cast-iron air gap.

It was explained to Mr. Walsh that, while his results were theoretically correct, they were not practicable, since air gaps of the cast-iron variety are comparatively scarce in engineering practice.

BOOKS RECOMMENDED FOR ENGINEERING STUDENTS

A list of books has been compiled by a committee to aid engineering students in obtaining material not particularly related to their own work as well as material relative to their individual fields.

The books are listed under the general classifications: English, Economics, Science, Mechanics and Materials, Chemical Engineering, Metallurgy, Mining, Civil Engineering, Mechanical Engineering, Electrical Engineering, Aeronautical Engineering, Dictionaries and Handbooks. Appropriate sub-headings are employed for further classification. The title, author, date, publisher, and price of each book are given.

The list includes two or three especially adaptable books on each subject, giving the student an opportunity to obtain comprehensive information without endless searching in bibliographies. Since most of these books are available at either the Engineering or University Library, students should avail themselves of this convenient facility. A mimeographed copy of this list may be secured from Prof. F. E. Volk, Librarian of the Engineering Library.

NEW DISCOVERY—VALVES MOVE UP AND DOWN

While discussing the cooling system of the valves of an internal combustion engine, the students of a section in Steam and Gas 109 were excited to mirth when Gerhard Assenheimer, m'34, advanced the statement that "those valves won't stick very easily because they move up and down."

FACULTY MEMBERS REVISE TEXT

E. F. Turneaure, Dean of the College of Engineering, and E. R. Maurer, Professor of Mechanics, announce the publication of the revised fourth edition of their test "Principles of Reinforced Concrete Construction." The text is very highly recommended by both the *Engineering News-Record* and the *Engineering Review*.

The fourth edition of this book, in continuous use by civil engineers since 1907, follows generally the plan of the third edition. The book presents in a systematic manner the principles underlying the design of reinforced concrete structures by giving the results of tests, aids in the establishment of working stresses, and illustrates theoretical principles by examples from actual design.

KROENING, c'34, BREAKS BOWLING RECORD

One season record was relegated into the background when George Kroening, c'34, of the Dean's Nite Club team broke into the sport world and rolled up a score of 679 in bowling on the night of November 9. He topped the former mark of 673 made by Jack Thiede.

Until this year his prowess was largely confined to his participation in contests in the Inter-Fraternity league of the University. His first game yielded a score of 225 which tied the record for high single games. A split in the final frame of his last game prevented him from joining the exclusive 700 club which is the dream of all ambitious bowlers. His score card showed 20 strikes, 10 spares and a foul, in addition to the aforementioned split, which is top form bowling in any man's language. His performance proved to be the highlight of the evening.

CHI EPSILON AWARDS HANDBOOK

The annual award of Chi Epsilon, honorary civil engineering fraternity, in the form of an engineers' handbook, was made to William F. Reynolds by Aubrey J. Wagner, former president of Chi Epsilon, at Freshman Lecture on Friday, October 14. This award is made annually to the highest ranking freshman civil of the previous year. The object is to promote scholarship among the freshmen.

ENGINEERS AT BARNARD

Charles "Cully" Bismark Bloedorn ventured over to Barnard Hall the other afternoon to 'teach his gal some math.' An hour or so passed and they were deep in the study of "Curve Analysis" (in a dark corner) and suchlike matters. Then came light. Miss Ross, house mother, came upon them unawares, and, as she said, she felt it her duty "to ascertain whether the dark sofa was occupied by one girl, two girls, or a girl and a gentleman." Cully reports that she is an interesting conversationalist and is blessed with a thorough knowledge of the subject of "Preserving One's Individuality on the Front Sofa."

ANGLES

R. Dittman (Ditty), c'34, learned Friday in a Descriptive Geometry class that it is not necessary to construct 45, 30, or 60 degree angles with a pair of dividers and the tangent method. He announces his intention of delving more deeply into the matter of the uses of celluloid triangles in the near future.

ROLLER SKATING

Several of the more serious minded young Engineers have lately taken to roller skating. Among them are Carl Liedecker, e'36, Edgar Bubbert, e'35, Harold Goldberg, e'34, and Bob Engelhardt, c'34. They report that the floor is hard in spots and the corners most annoying. Intricate problems involving momentum, centrifugal force, gymnastics, and the law of gravity have been encountered, but the problems are gradually being solved by the trial and error method. Nevertheless, they report that a swell time was had by all and announce their intention of keeping up the good work.

Roval H. Wood, m'33, president of Tau Beta Pi, represented the Alpha Chapter of Wisconsin at the annual convention at Washington, D. C., on October 13, 14, and 15.

The wife of Professor E. R. Maurer, chairman of the mechanics department passed away on the night of November 6 after a lingering illness. Mrs. Maurer was active in faculty social groups.

« CAMPUS ORGANIZATIONS »

POLYGON ANNOUNCES ALL ENGINEERING DANCE

Polygon announces that it will sponsor another one of its All-Engineering Dances, Friday, November 18, in the Great Hall of the Memorial Union. Music will be furnished by Norm Phelps and his Orchestra, the popular Saturday Nite Cabaret Dance Band.

Polygon has been bending its efforts during the past years toward unifying the engineers in the college and getting everyone to know everyone else. To this end they have sponsored a number of smokers and informal dances during past years. They officially opened the new Mechanical Engineering Building to social functions with an excellent party and dance last year. Those who remember this party and the Spring Informal held in the Memorial Union in May, will need no second invitation to bring their best date and join in the fun at the Union this Friday night.

The party Friday evening will be open to all engineers and their friends. If you are not there you will be out of all the fun, so bring your dollar and your date and join in making the party the best ever. Any profits will be used to sponsor more of the very entertaining smokers for which Polygon has been known in the past.

A. S. M. E. PLANS AWARDS FOR PAPERS

The schedule for the American Society of Mechanical Engineers Awards to the student members presenting papers was reviewed and discussed at the second meeting of the Wisconsin Student Branch, Tuesday evening, October 18.

The Executive Committee decided that the silver cigarette case given by the Aeronautical Division of the Society is to go to the member presenting the second best paper during the year. The member presenting the best paper will be delegated to attend the student convention of A. S. M. E. in Chicago in the spring. There he will present his paper in competition with other delegates for cash awards.

Under the new plan for student branches, which was introduced at Wisconsin at the first meeting on September 29 by Mr. Earnest Hartford, national assistant secretary, each society is to decide which of the classes shall receive full membership into the student branch. The Executive Committee reported as their decision that Juniors and Seniors only shall wear the pin, receive the "Mechanical Engineering" magazine, and pay dues of $3.00 per year. Sophomores will share with Juniors and Seniors the right to vote, present papers, and receive the "A. S. M. E. News," but they pay only the initiation fee of $1.00.

The program of the evening consisted of a talk by Prof. J. F. Oesterle of the Mining and Metallurgy department on *Manufacture of Open Hearth Steel.* Prof. Oesterle described in a very thorough and interesting manner the chemical principles involved in the reduction of pig iron to steel, and also the construction, charging, and operation of the open hearth furnace. He brought his talk to a close by showing a moving picture of production of open hearth steel, and the rolling of the steel into rails. Prof. Oesterle has spent several years as inspector in the steel mills at Gary and in the East, and was thoroughly familiar with his subject.

John F. Robertson, '33, is the Chairman of the Program Committee which has been responsible for the programs this year. We trust that the remaining programs will be as interesting and worth while.

LYNEIS WILL ATTEND NATIONAL CONVENTION OF CHI EPSILON

Claude J. Lyneis, president of Chi Epsilon will be the delegate from the local chapter at the 1932 National Conclave of Chi Epsilon to be held at Penn State College, November 19. Professor Ray S. Owen, national secretary-treasurer of Chi Epsilon, and Franklin T. Matthias, editor of Chi Epsilon's official publication, "The Transit," are attending the Conclave as other Wisconsin representatives.

The fall edition of "The Transit" is now in the hands of members of Chi Epsilon. It contains numerous articles about prominent engineers, articles on engineering aspects of architecture and engineering education, and a wealth of news about various chapters of the organization. Of special interest to Wisconsin men is a short Biography of D. W. Mead, professor of Hydraulic Engineering, who was recently made a national honorary member.

TAU BETA PI

Tau Beta Pi has, for several years, followed the practice of awarding a slide rule to the sophomore engineering student who, at the end of his freshman year, held the highest average in his class.

This year a little difficulty was encountered because two men, Fred Kuehn, e'35, and William Van Ryzin, m'35, were tied for first place with 34 credits and 92 grade points. Because of lack of funds it was impossible for Tau Beta Pi to give both men slide rules. Through the generosity of the University Co-Op, however, a second slide rule was obtained, so that each of the high ranking sophomores received a log-log duplex slide rule. The thanks of Tau Beta Pi is hereby extended to the Co-Op for their generous action.

In previous years, polyphase duplex rules have been awarded. This year it was judged better to give a log-log rule, since it is much more useful than the polyphase duplex rule.

ELECTRICALS WATCH BUILDING OF THE AKRON

The engineering problems incident to the building of a large dirigible were reviewed through the medium of a two reel moving picture of the construction of the U. S. S. Akron at the first meeting of the A. I. E. E., Wednesday, October 19, in the Engineering Building. The building of the Akron was one of the outstanding engineering achievements of last year discussed.

The Society intends to make a concerted effort to win the national and district prizes of one hundred and of twenty-five dollars respectively offered by the parent branch of A. I. E. E. for the best technical papers presented by students at regular meetings. Definite plans for winning of these prizes have been made.

Several small groups of members will go on inspection trips to industrial plants around Madison, meeting the executives and observing operations as the result of heartily endorsed plans approved at the last meeting.

A. S. C. E.

Professor L. F. Van Hagen, of the Railway Engineering Department enumerated the various benefits of membership in the student branch of A. S. C. E. in his talk to the members of A. S. C. E. at their first meeting on October 12. He explained the function of the A. S. C. E. employment agency which is capable of aiding the members who are looking for a job.

Some of the other advantages of belonging to this society are the opportunity to receive the "Proceedings" of the A. S. C. E. at reduced rates; to obtain at cost any papers issued by the A. S. C. E.; to wear a facsimile of the A. S. C. E. regulation badge; to obtain membership cards; to use regulation A. S. C. E. stationary, to be able to attend meetings, inspection trips, and excursions made for the members of A. S. C. E.; and to be able to join the parent organization without much red tape.

The principal speaker of the evening was Mr. H. D. Blake of the Wisconsin Highway Commission. Excerpts from his speech will be found on the Campus Notes page of this issue.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS HOLD MEETING

The Student Section of the American Institute of Chemical Engineers held their first meeting of the year on Oct. 4, 1932. After a welcome by Counsellor Otto Kowalke there was an election of officers and refreshments. The new officers are:

A. L. Brandlhofer ---------------- *President*
Walter Woods ---------------- *Vice-President*
Margaret Donnelly --------- *Secretary-Treasurer*

The membership was increased to forty-five and present indications point to a very successful year for A. I. Ch. E.

Second Meeting of A. I. Ch. E.

A very interested crowd of about one hundred and fifty engineers and other scientifically minded people were entertained by Dr. J. H. Mathews, an eminent chemistry professor, who lectured on "Scientific Crime Detection" on November 8. The methods of crime detection he described were only a few of the many different angles of detection.

The metagraphic analysis was first used in a crime case a few years ago. This method consists of telling whether two pieces of a metal or alloy came from the same melt or not by a study of the structure of the metals under a microscope. The grain size and shape, the slag distribution, and the effect of etching on the two specimens are characteristics which are compared in the two samples. If these are the same, then it may accurately be concluded that these are of the same melt.

The examination of a bullet that was used in a crime also is conclusive evidence in a crime case. A like bullet is procured and fired in the gun the criminal was supposed to have used. Every gun has its own characteristic grooves, etc., so that every bullet fired from it has characteristic grooves and marks. If the test bullet is found to have the same characteristics as the bullet used in the crime, this shows that both were fired from the same gun. These are tested under a double, compound microscope. One bullet is put under one microscope and the other bullet is placed under the other. By the use of prisms in these microscopes half of one bullet is focused into the eyepiece together with the opposite half of the other bullet. In this view the two halves appear as one bullet. If these two halves coincide perfectly it is conclusive proof that the two bullets came from the same weapon. Photomicrographs are taken of all the specimens and presented at court as evidence.

« ALUMNI NOTES »

CIVILS

Ferguson, Perry F., c'32, has not found a job as yet. He spent the summer working on his father's small farm at Fairview, Pennsylvania.

Euclide, Francis J., c'31, who has been working with the Highway Commission at Green Bay, visited Madison on October 21 and stated that he had been laid off on August 31. He also informed us that **John J. Fitton**, ex-c'28, who has been with the Green Bay Division for several years was laid off on October 15, and that **Paul W. Bishop**, who has been resident engineer with the same division, is to be laid off in October.

Zibell, Jerome, c'31, is taking graduate work at the University this year. He is specializing in Sanitary Engineering.

Arnold, James W., c'30, is employed as an engineer in the Airways Division of the Department of Commerce. His headquarters were at St. Louis during the summer months.

Kulp, John H., c'29, is employed as a Commercial Representative of the Michigan Telephone Company at Detroit.

Lucht, H. C., c'29, is an appraisal engineer in Milwaukee. His address is 2771 N. 51 Street, Milwaukee.

Ward, Gerald C., c'29, a former editor of "The Wisconsin Engineer", was in Madison the first few days of this month. He is a college representative for the McGraw-Hill Book Company with the Big Ten as his area. His office address is 330 W. 42 Street, New York City.

Ziehlsdorff, Walter C., c'29, was married to Elise A. Berget on June 14. He is a junior assistant highway engineer with the Wisconsin Highway Commission. He is living at 1904 Kendall Avenue, Madison.

Taber, Henry W., c'16, became the father of a son, Rowland Whitney, on June 1, at Denver, Colorado.

Penn, W. C., c'07, C. E.'15, is treasurer of the Nantahala Power and Light Company at Bryson City, N. C.

Boley, C. U., c'83, died at Sheboygan, Wisconsin, on July 19, after an operation. He retired as City Engineer of Sheboygan in 1931 after 43 years at that position. At the time he retired he was the oldest city engineer in point of service in the country.

MECHANICALS

Mercer, Gordon R., m'32, is head clerk for the Weber Brothers Grocery Stores, at Marshfield, Wisconsin. He thinks the grocery business is about as good as any at the present time.

Simpson, William D., m'31, is employed by the Buffalo Forge Company, at Buffalo, N. Y. He is in their engineering department.

Icke, Phillip, m'30, has returned to the Market Research Section of the Publicity Department of the General Electric Company at Schenectady, after several weeks' work in the Chicago office of that Company.

Vilter, Ernest F., m'27, became the father of a son, Peter Frederick, on June 15, at Milwaukee.

Nerad, A. J., m'23, is with the Engineering Research Section of the Research Laboratory, General Electric Company, at Schenectady, N. Y.

Warren, G. B., m'19, M. E.'24, Designing Engineer of the Steam Turbine Department of the General Electric Company, was the author of a paper on "Commercial A-C Time Service and Synchronous Clocks", read at the International Electrical Congress in Paris, July 4 to 12, 1932.

MINING

Ehrlinger, H. P., min'31, of Fort Wayne, Indiana, has just completed a study of the zinc regions of Tennessee, with particular interest in the possible production of zinc electrolytically.

Johnson, Albion, min'29, who is with the American Brass Company at Kenosha, Wisconsin, visited the department this summer.

Crawford, Howard D., min'27, M. S.'31, is at Wausau, Wisconsin.

Lorig, Clarence H., min'24, M. S.'25, who is Research Metallurgist at Battelle Memorial Institute at Columbus, Ohio, visited Madison late in August.

Jones, T. D., min'22, Met.E.'29, visited the University this summer. He is Chief Metallurgist for the American Smelting and Refining Company at their Perth Amboy plant.

Wegner, Gilbert E., min'22, is enrolled as a graduate student in the department. Mr. Wegner was Metallurgist for several years with the International Smelting and Refining Company at Tooele, Utah. For the past five years he has been Metallurgist for the Anaconda Copper Company at their operations carried on under the name of Giesche Spolka Akcyjna, Katowice, Poland. He is now home on a one year leave to do special work in metallurgy here at the University.

Jourdan, Ralph L., min'21, is Assistant General Manager of the Utah Division of the American Smelting and Refining Company, with headquarters at Salt Lake, Utah.

Link, Marcus W., min'21, is engaged in the mining of fluorspar, at Millikan, Kentucky.

Mann, L. R. min'21, M. S.'21, is located in Butte, Montana.

Hymer, Howard G., min'20, is Superintendent of the Wabigan Mine of the M. A. Hanna Company at Hibbing, Minn.

Brintnall, P. C., min'13, E. M.'17, is with the Omaha Division of the American Smelting and Refining Company at Omaha, Nebraska.

ELECTRICALS

Affanasiev, Kosmo, e'32, has a temporary job with the Wisconsin Public Service Commission as assistant electrical engineer. He received the position as the result of a civil service examination in which there were about sixty applicants. He plans to return to school when the job terminates.

Hovey, John, e'32, has left the engineering profession for the present and is a salesman for the National Guardian Life Insurance Company in Madison. His friends need not avoid him, for he has promised not to mention insurance until asked about it.

Sargent, Harvey C., e'31, has accepted a position with the Superior Light and Power Company at Superior, Wisconsin. He will be in charge of the electrical meter department. Harvey was married to Margaret Leyder of Madison this summer.

Kraut, R. J., e'30, was married to Ruth Susan Beymer, on July 25 at Madison. Mr. Kraut is now with the Publicity Department of the General Electric Company at Schenectady.

Ajer, O., e'29, is with the Research Laboratory of the General Electric Company at Schenectady.

Hibard, Glen, e'29, is now attending Northwestern University and studying for his Masters in Business Administration.

Bowen, James, e'28, is an electrical engineer with the San Diego Consolidated Gas and Electric Company at San Diego, California.

THE ENGINEER

(Continued from page 23)

men and insurance agents. Some of the remaining souls, after working incessantly as engineers, gain success by becoming advertising managers, accountants, salesmen and managing executives. But, alas, some fail and become Assistant Chief Engineers, Chief Engineers, and if complete failures, become Consulting Engineers.

Our government has had two famous engineers who gained fame by ceasing their chosen occupations and becoming Public Servants — George Washington and Herbert Hoover. An engineer with the temperament of a grand opera star is an inventor and can be recognized by long hair and flowing bow tie.

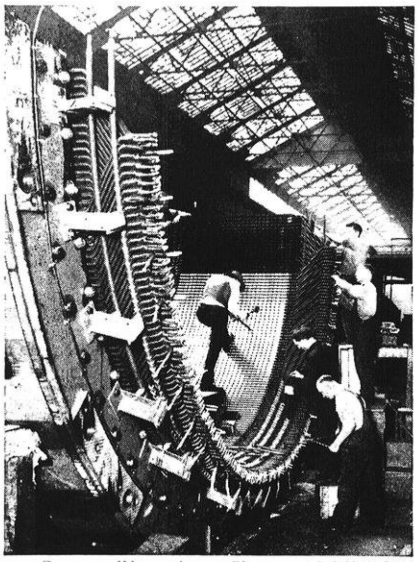
There is only one engineer on record who has become rich. He recently died in Colorado and left a fortune of $50,000 which he amassed through unceasing toil, superhuman perseverance, remarkable ingenuity and the death of an uncle who left him $49,995.00.

Engineering is a good deal like golf. Those who are good drivers become managing executives; for those whose best shots are brassie, the advertising profession offers a good opportunity in case of a good lie; those who approach well find salvation in salesmanship, and those good on the green become cashiers and investment brokers. The duffers remain engineers.—*Anonymous.*

ENGINEERING REVIEW

GIANT GENERATOR REQUIRES SKILL AND PRECISION

This huge half-hoop is part of the stator of a powerful waterwheel generator now being built. It is one of four such units to be installed by the



—*Courtesy Westinghouse Electric and Mfg. Co.*

Hydro-electric Generator during Winding Process

New Kanawha Power Company, near Charleston, West Virginia, a unit of the Union Carbide and Carbon Corporation. The precision with which these skilled workmen are winding tons of wire and miles of tape is just as great as that required of a watchmaker.

WESTINGHOUSE STUDIES CORROSION OF WELDS

The effect of corrosion is becoming so important in welded boilers, pipes, containers for oil and chemicals that the Westinghouse Research Laboratories are studying it with special apparatus. In welded structures of rustless steel, alloys, or monel metal this problem is vital. The results of these studies may tell engineers how to fabricate structures so that all parts will be uniformly resistant to rust.

In a weld of low-carbon steel corrosion may be expected to start in the zone where weld metal meets parent metal. At this point, according to the electrolytic theory of corrosion, a potential difference may exist which is responsible for an accelerated attack. Oxides and other heterogeneous par-

EDITOR'S NOTE

The cuts for the "Engineering Review" feature, for this issue and the October issue of this magazine were funished through the courtesy of the Westinghouse Electric and Manufacturing Company.

ticles, if present in the weld, tend to hasten corrosion by the formulation of electrolytic cells. The soil corrosion of pipe line is an example. A more homogeneous weld should be expected with coated welding wire than with bare electrodes since the coating resists the entrance of foreign elements.

To corroborate many facts already known on this subject and to uncover others, a special corrosion device has been built which greatly hastens the slow process of rust. In it the test specimens are subjected to intermittent immersions in a corroding liquid. The apparatus suddenly immerses the samples for a definite period, leaving them at rest, and then removing and exposing them to air for a definite period. They are moving only when being lowered or raised — a time which is a very small fraction of the cycle.

Samples are suspended from a rack by glass hooks, horse hair, or silk, and a motor-driven crank shaft raises and lowers the rack. The driving motor is controlled by a timing device composed of a synchronous motor operating a contact, which causes the motor to periodically turn the crank shaft a half revolution. The timing can be set for any cycle of test operation. To obtain reproducible results the corrosive liquids are kept at a constant temperature, by circulating water of a constant temperature along the outside of the vessels containing the corrosive liquids.

ALLOYED PUDDLED IRON IS NEWEST METALLURGICAL DEVELOPMENT

A new development in the manufacture of wrought iron is announced by The Highland Iron & Steel Company, in a recent statement that they are now in regular production on wrought iron alloyed with nickel, with copper, with nickel and molydbenum and with copper and molydbenum.

Several years of intensive research work preceded actual production.

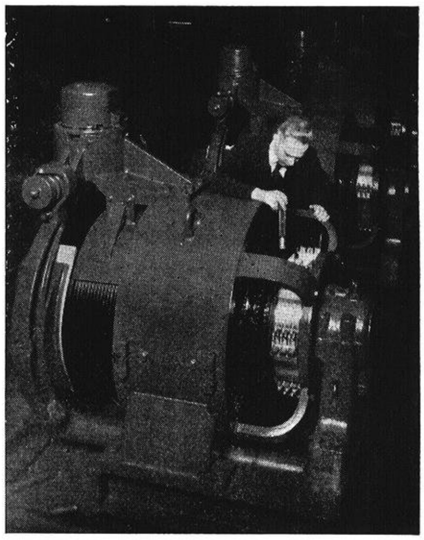
This development of alloyed wrought iron opens greater fields of usefulness for this material without changing in any way its fibrous structure which is responsible for endurance of wrought iron under vibratory stresses, but at the same time has resulted in a 25% increase in the strength of the material in the as-rolled condition.

Of these alloys, wrought iron with nickel alone and with nickel and molydbenum have outstanding characteristics. Both have shown a marked increase in fatigue-resisting properties.

Heat treated nickel and nickel molydbenum wrought iron shows an increase in strength of 40% to 50% over ordinary wrought iron.

ELEVATOR MOTORS FOR ROCKEFELLER CENTER

Motors to operate the 74 elevators at speeds ranging from 100 to 1200 feet per minute are being installed in the "Central Tower" in Rockefeller Center, New York. Sixty-five elevators will use gearless machines of



—*Courtesy Westinghouse Electric and Mfg. Co.*

Gearless Elevator Drives for Rockefeller Center

which seven will be service and freight elevators with speeds of from 500 to 700 feet per minute, and fifty-eight will be passenger elevators running from 700 to 1200 feet per minute. Lower speeds will prevail for the first 16 floors.

Desert air *is wet*

. . . by comparison!

Making telephone equipment presents many an interesting problem to the engineers of Western Electric—manufacturer for the Bell System.

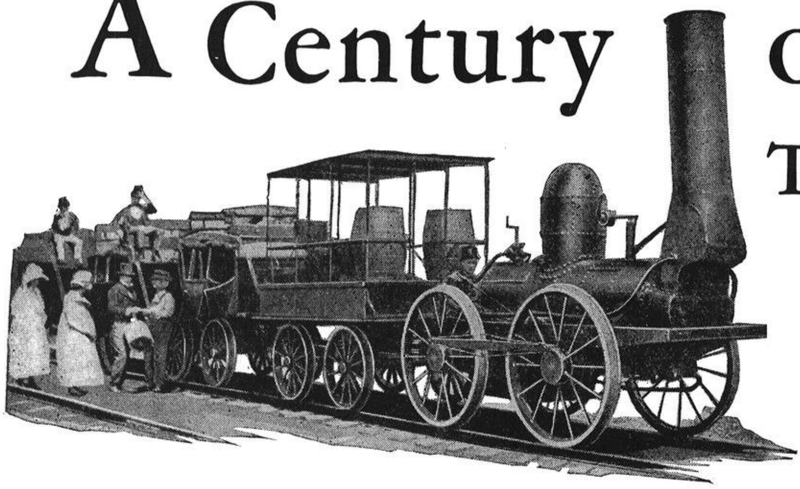
A case in point is the drying of telephone cable before putting on the protective lead sheath. This step is of utmost importance, for the tiny copper wires cannot carry your voice properly unless their paper insulation is thoroughly dried. To this end, Western Electric engineers devised special drying ovens in which the air is *thirty times dryer* than desert air!

The same ingenuity and thoroughness go into every step of making cable, telephones, switchboards and many other kinds of telephone equipment. The dependable apparatus that results is one reason why Bell System service is dependable.

BELL SYSTEM

A NATION-WIDE SYSTEM OF INTER-CONNECTING TELEPHONES

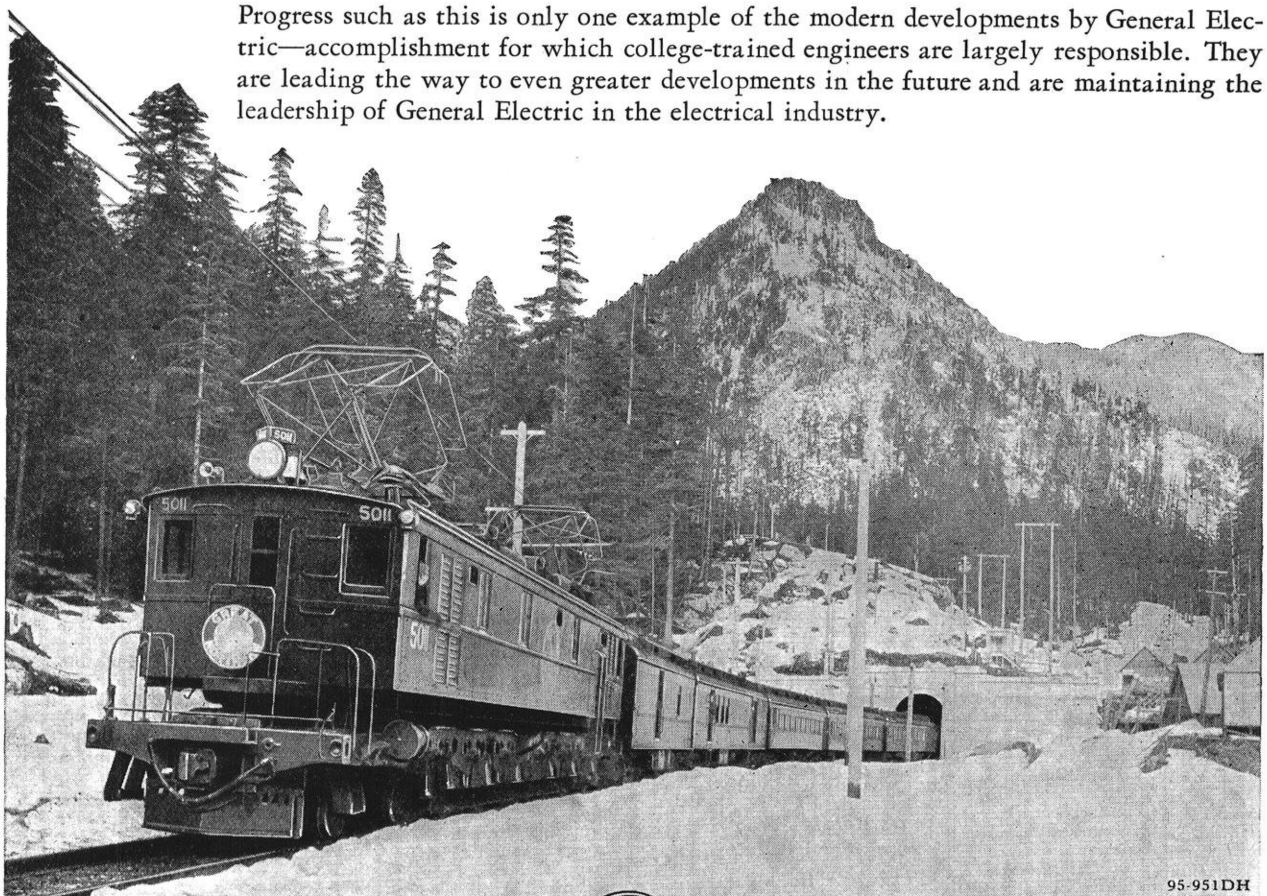
A Century of Rail Transportation



A RACE between the horse and the locomotive has started. The *De Witt Clinton*, that awesome "iron horse," is puffing and plodding away from Albany to Schenectady at the high rate of 22 miles per hour. The snorting monster, showering sparks and smoke all over its passengers, frightens cattle and farmers' horses all along the way. The *De Witt Clinton* arrives in Schenectady, having covered the seventeen miles from Albany in 46 minutes. Trailing behind, seven horse-drawn coaches arrive a half-hour later. The horse has met its first reverse.

To-day, more than a century later, we see a mighty 260-ton General Electric locomotive of the Great Northern Railway as it emerges from the scenic west portal of the 8-mile Cascade tunnel in Washington. What a contrast to the quaint *De Witt Clinton!* This modern 3000-horsepower locomotive smoothly and swiftly pulls a thousand-ton train over the many grades of the Great Northern route.

Progress such as this is only one example of the modern developments by General Electric—accomplishment for which college-trained engineers are largely responsible. They are leading the way to even greater developments in the future and are maintaining the leadership of General Electric in the electrical industry.



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