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THE WISCONSIN ENGINEER

IN THIS ISSUE

Travel By Air

Problems in Rural Electrification

Air Conditioning of Railroad Cars

ENGINEERING SOCIETY OF WISCONSIN ISSUE

MARCH 1937

Member, Engineering College Magazines, Associated

Wearproof by Welding

Thus engineers obtain the service of the best alloys at the cost of ordinary steel

THROUGHOUT industry, wear on metals is an important cost factor. Until recently, most wearing parts had to be made entirely of special high-cost materials. Now, by welding, rapidly wearing surfaces can be covered with a wear-resistant alloy. Welded additions of bronze or Haynes Stellite—a wear-resisting alloy of cobalt, chromium and tungsten—create excellent wear resistance at low cost.

Long Life at Low Cost

Wherever metal has hard work to do, wearproofing by welding plays an important part. Under the toughest conditions, in mines and mills, in factories and on farms, in construction and oil-drilling, it is saving money and time.

Wearproofed parts will last many times as long as those made of unprotected iron or steel. Welding cost, including the necessary alloy, is only a fraction of the total cost of a new part. Then, after long, hard service, the part can be re-covered—another wear-resisting surface can be welded on at small cost, and the part is again as good as new.

Extensive Savings

Savings through the application of wear-resistant alloys are not confined to the lower cost of the part involved. Less power is used. Inventories are cut due to the consequently lowered investment and simplified control. Machine shutdowns for replacement are fewer. Maintenance costs are decreased, and a smaller crew can handle the necessary repairs. Further, the plant, without added equipment, can turn out a greater volume of production.

Figures drawn from case-histories where wearproofing is used are often surprising. A glance at the adjoining column will indicate many of the possibilities inherent in this process.

INTO THIS YAWNING CAVITY goes the dirt to make Grand Coulee Dam. Bucket front and teeth were hard-faced by welding. The result of this wearproofing was six months' service on Bonneville Dam, and many more months of trouble-free, repairless service on Grand Coulee.

Welding Savings

Welding makes automotive exhaust valve seats good for 150,000 miles and more, with no regrinding in truck and bus motors, the toughest kind of service. These valve seats are wearproofed by welding Haynes Stellite to the contact surface. Ordinary cast-iron seats need regrinding every ten thousand miles.

* * *

Welding saved $2200 in one year for an Ohio pulp mill. Haynes Stellite was welded to the wearing surfaces of shredder knives. This work cost $90; knives, from the scrap heap, cost nothing. Hard-faced knives lasted for six months, and were again refaced by welding. New knives cost $200, last one month.

* * *

Welding a wear-resistant facing on the cutting edges of boiler-tube cleaners yields a twenty-fold saving—each cleaner will clean twenty times as many tubes as an ordinary cutter. When worn, hard-faced cutters are rebuilt for another long service.

* * *

Welding cured pump troubles in a pulp mill. Shafting on a sludge pump was wearing rapidly. Packing glands had to be tightened every hour, completely repacked once a week. The shaft was fast disappearing. Hard-faced by welding with wear-resistant metal, the shaft ran for three months with no attention, no appreciable wear.

* * *

Welding lengthens the life of blooming-mill shear clutches three times. Clutches previously ran 49 days, then went to the scrap pile. Now, wearproofed by welding, these clutches average 217 days before any attention is necessary. The same clutches are then refaced and used again.

* * *

Welding has solved an impossible lubricating problem. At a Southern mill where heater furnaces are fed by internal conveyor, rolls and bearings operate at 750 degrees Fahrenheit. Lubrication is impossible. A wear-resistant coating, built up on the rolls and bearings by welding, makes the conveyor last indefinitely, eliminates *need* for lubrication.

* * *

Tomorrow's engineers will be expected to know how to take advantage of this modern metalworking process. Many valuable and interesting technical booklets describing the application of the oxy-acetylene process are available without obligation. For further information write any Linde office.

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Engineering Building

With the Contributors . . .

- Last year's editor, Leo. S. Nikora, is back again with another article on the subject of interviews. It's good, see page 102.

- There are lots of reasons why you should travel by air. Harold Leviton, junior mechanical, gives some of them beginning on page 104.

- During the recent Engineering Society of Wisconsin Convention held here, Mr. J. A. Becker presented an excellent paper on problems encountered in rural electrification. Read it, starting on page 106.

- See the list of Wisconsin men who are receiving flight training in the U. S. Naval Reserve on the Alumni Notes page.

- Another paper presented before the Engineering Society of Wisconsin Convention had to do with air conditioning railroad trains. Part of it is printed, beginning on page 116.

The Wisconsin Engineer

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Volume 41 **MARCH, 1937** **Number 6**

CONTENTS

MEMBER OF ENGINEERING COLLEGE MAGAZINES, ASSOCIATED

Prof. Richard W. Beckman, *National Chairman*
Iowa State College, Ames, Iowa

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas Engineer
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-Log
Nebraska Blue Print
North Dakota State Engineer
N. Y. U. Quadrangle
Ohio State Engineer
Oregon State Technical Record
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Villanova Engineer
Washington State Engineer
Wisconsin Engineer

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THIS SOLILOQUY NEVER HAPPENED

By LEO S. NIKORA, m'36

I will soon be a college graduate engineer.
I have the finest and most modern education in the world.
I am healthier now than I shall ever be again.
I can, because I am young, withstand shocks, privations, hunger, almost anything.
I can learn quickly and easily, my mind being still flexible, accustomed to learning, and partially permeated with some sound fundamental facts.
I am willing, uncynical, idealistic, an optimist and "never-say-die-er."
I have companies from all over the country COMING TO SEE ME, *offering me a chance for a place in industry. A year from now, I shall find it difficult to gain attention from any one of them.*
I am living in an era of industrial expansion rising out of the worst depression in my country's history. My opportunities are innumerable and unlimited.
I can now, depending upon my choice of employers, make, maim, or break my future.

Wouldn't I be a fool to close my eyes, point somewhere down the list, and say, "That's the one"?

MY BIGGEST trouble right now is this employment business. Doesn't seem to me that I am going at it in the right way at all. For two reasons.

In the first place, I do not approach an interviewer properly. At no time have I walked up to the gentleman and felt that I was really going to sell my stuff to him. In fact, by George, instead of pulling myself together to tell him why he should hire me, why I am the logical candidate, what I can do and have done, that my interest and learning are centered in the type of work he can offer—instead of that, I find myself shaking hands with him, dead-fish-like, sitting down because he told me to, answering questions respectfully, saying goodbye when everything suddenly became painfully silent, and walking out hoping that the old boy would give me a break. Ten interviews later, I am catching on a little.

Now I've got to admit that that's not the way to get a job. For one thing, I don't know a thing about the company. Oh sure, they make something or other. Outside of that, I'm plenty ignorant. Whether they are reliable or not, if they've had any strikes recently, their officers, how old the company is, what money they've got behind them, how big they are and where their plants are located—all of that is beyond me. And none of the fellows around here seem to know much more than I do. Guess I'll have to take a peek at **Moody's Manual** before the next interviewer gets here. And maybe I should write to some friends of mine who are in a position to give me a few details.

Because right now I am getting the jitters. Some companies, I hear, hire a lot of fellows at one time, try them out for a year or so, and then give half of them the push. A fine pickle I'd be in then. Or I could do just as badly by going into an outfit that starts you off at a pretty high salary and cuts it down after a few months.

It's a funny thing. For four years I've been learning engineering. How to think properly and logically. And the way I'm trying to get a job to use this engineering education is the most illogical thing I've ever done. How can you solve a problem without data?

> ***College . . . a shielded world. Utopian in its government, myriad in interests, unified in spirit, atmosphered with intelligence and idealism. In it, the instinct of self-preservation is only an academic fact. The greatest catastrophe is a low grade. Failure can be nine-lived, but is always provided with chances to regain. Effort is rewarded, excellence acknowledged. Aptitude is encouraged, help proffered. Here Life gives us the parting nectarsip to childhood's beautiful oblivion.***

But the other reason for the present dilemma is worse—maybe even the cause of the first reason. And that is, I don't know what a lot of these personnel men are talking about. Am I interested in production? Production! What is production? I can't see any difference between it and manufacturing, but some of the interviewers even asked me which I preferred! One of us is the dummy, and a little voice says that no one but yours truly should be doing the blushing and getting the bird. So I think I'd better do some high class absorbing for the next few minutes.

"Production, manufacturing, research, and sales roughly form the four phases of industry today. These divisions are neither clearly defined nor always necessary in any one organization, as their explanation will readily reveal.

"The production department of an industry concerns itself with procuring of materials, which usually come from natural sources. Thus, the production division of a steel company would worry about mining iron ore and searching for new fields. In an oil company, crude oil, wells, and pipe lines would be the main feature of the daily program. In textile industries that department would watch crops of cotton.

"So, for a surveyor, a man of the out-of-doors type, the forest lover, the geologist, and geophysicist, the production department of a company would be an ideal work world.

"Manufacturing takes up where production leaves off. The business of converting the iron ore to shaped and rolled steel, of making gasoline and lubricating oil from petroleum, of changing cotton plants into house dresses, all such are handled through the manufacturing department of a corporation.

"It is not very hard to see that some companies do not have, in the strict sense of the word, a production department. An automobile corporation, for instance, buys materials, does a bit of machining, and puts all the things together to form a finished product. So do shoe factories, engine manufacturers, bridge campanies, et al. Such organizations really have only manufacturing phases.

"Now precisely what kind of person would fit into the manufacturing department of a company? Any one interested in machine work, repair and maintenance, time and motion study, shop methods, power generation, office work, products and their specifications, and the like. Whereas production would carry a man here, there, and everywhere into the 'wilds,' manufacturing would keep him indoors, and pretty well in one location.

"The research staff is an essential part of nearly every big enterprise today. Its men have to figure out what to do with the materials and how to do it. Design, invention, refinement, improvements, ideas, testing—all of these things go on in the research laboratory. And this is the place for the mathematician, the clever fellow, the brilliant specialist, the chap with a lot of letters after his name.

"Finally, there is the sales department, and what a diversified sort of thing it is. Distribution of the products, advertising, accounting, legalities, economics, service, personnel—a million things, it seems. Here flows the lifeblood of the organization. It must recognize or create a demand for the company products. And then it must sell those products!

"The sales department can well use accountants, advertising men, artists, psychologists, economists, lawyers, engineers, and what-not. And engineers can well be heroes in the sales cast. Because companies now-a-days not only sell products, but also give the customer, via an engineer, instructions on how to use them. Engineers make good trouble-shooters. If he has any speaking ability at all, an engineer is an ideal salesman, because he knows his work so thoroughly that he can win the customer's confidence. Moreover, he can link the "paper side" of a business with the manual side, since he has a very clear picture of what can and does go on in the company shops. His greatest asset is his training and ability to analyze and think through a given situation.

"How these departments function together can perhaps best be described in two hypothetical examples. The sales department may discover there is a demand for a certain thing. The research and production departments combine forces to find a satisfactory answer. After the production staff locates material, the research men figure out how to convert it into finished pieces. The manufacturing division now starts to duplicate the conversion on a large scale. Sales distributes it.

"Or, on the other hand, the research group may get an idea as to what could be done with some apparently useless by-product. The laboratory passes the meththod on to the shop, and from then on it is up to the sales department to create a demand for the new product."

Gone are the dinosaurs, the riches of Croesus, the Roman Empire, Archimedes' engines, Alexander's armies, even the little ills of yesterday. Riches, power, governments, machinery, men . . . they are empty idols and dying things defiling the temple of time; they are dust-covered, destroyed, and lost in the march of ages. Thought is Time's only rival in the race for endlessness.

•

Wasted, parasitic, and functionless is the man who adds no step to the staircase of thought.

My, my, how we live and learn. I guess I can see a little more than what first meets the eye in the above. If I want to move around and meet people, the research department of any company would certainly not be the place of my choosing. The sales end would probably be best for that.

Of course, another thing pops up in the old think-tank —my present potential status. I am just lucky enough to get a college degree when companies are looking upon engineering graduates as executive fodder. So I am not being too grandiose in my dreaming if I look upon myself as someday managing a section of an organization. Indeed, I ought to be preparing for such a position right from the start. A house doesn't have to fall on me before I can understand that being a linesman, tool-maker, tester, or travelling salesman is but a step toward an end, although the steps as well as the goal must be interesting to me if I would be successful.

Well, maybe I'd better stop thinking for a while. Too much of a strain. Any minute now I might get a brilliant idea, and the shock would probably kill me. At any rate, the next interviewer that finds me walking in to see him is going to be surprised to find one fella with a pretty neat knowledge of the business, a corking good idea of what part of the company he could be used in, and a lot of strong and earnest arguments for the job.

. . . . And no more dead-fish-handshakes!

TRAVEL BY AIR

by **HAROLD LEVITON, m'38**

COMMERCIAL aviation, while still in its infancy, threatens to soon become a serious rival to the railroads and other modes of passenger travel. On long flights the airlines offer unbeatable competition in the matter of speed. Before long, they hope to make theirs the major means of distance passenger transport and they stand a good chance to succeed.

At present, the airline business is thriving. At peak loads, such as on holiday weekends, its facilities are taxed to the utmost. It can be safely said that this industry, which had to find itself during the depression, has successfully weathered the storm and faces a most promising future.

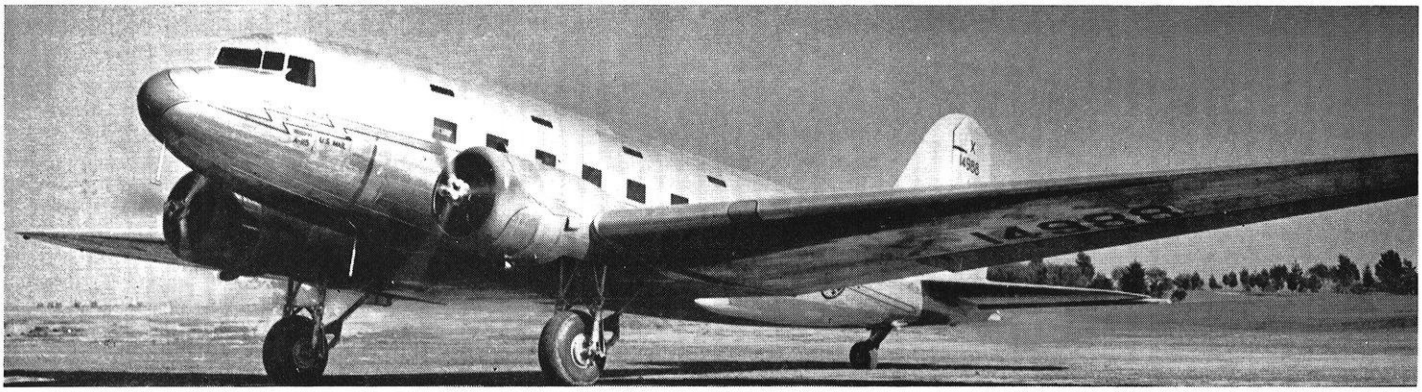
But it has been a gruelling, uphill struggle. The industry, scarcely ten years old, wobbled badly at the start, as the early planes were small and crude, and, most of all, there was that widespread fear of flying. The needed stimulus was injected in 1933 with the introduction of the swift and luxurious twin-motored Boeing and Douglas transports. These are now being replaced by giant twenty-one passenger Douglases, the last word in flying luxury. Forty-passenger planes will be along in a year or so.

The history of commercial aviation in its recognized form really began in May, 1926, when the post office turned over air mail operations to private enterprise. The first route was established between New York and Washington, and transcontinental service, three days coast to coast, followed soon after. But it was not until 1928 that night mail flying was inaugurated, cutting this time to 33 hours. The scheduled coast to coast trip now takes 17 hours.

In that pioneer period before radio, beacons, and good airports, the original airline companies were formed. Most of them were incorporated for the express purpose of cashing in on the then lucrative air mail contracts, and bothered very little with the passenger angle. With the cancellation of air mail contracts in 1934 by the federal government, a costly move both in lives and money, the operators realized that they must carry sufficient cash customers and freight to protect themselves against similar governmental whims. Mail revenues today constitute less than one-half the gross earnings.

At the time the Air Mail Act was adopted in 1934 nearly all transport firms had a highly involved corporate structure. United, one of the largest, was then composed of the airline, four airplane factories, a propeller factory, an engine company, a flying school and an airport. Since the act stipulated that operating and manufacturing companies be separated, United Airlines Transport Company was formed, comprising the airline, the Boeing School of Aeronautics, and the Union Air Terminal at Burbank, California. United Aircraft Corporation took control of the rest.

The original unit of what now is American Airlines was founded in 1923 by a group of Connecticut aviation enthusiasts. In 1926 it was carrying mail between Boston and New York under the name of Colonial Airlines, with two subsidiaries to Montreal and Cleveland. By 1929, fourteen of these smaller units, comprising the routes American now flies, were gathered under the name of Aviation Corporation, and partially consolidated under five divisions. The following year the five divisions were combined into a single concern known as American Airways, Inc. Control was assumed in 1933 by the Cord Corporation, a large automotive and plane manufacturing combine, but the Air



Douglas sleeper plane for 16-24 passengers

—AERO DIGEST

Mail Act proceeded to cut off Cord, and the name American Airlines was selected for the resulting operating company.

Along with the rapid progress made in commercial aviation has been the development of modern and well equipped airports. The beacons, floodlights, radio beams, and traffic control towers are needed to guide the increasingly large number of planes to safe landings. At the Newark (N. J.) Airport, the world's busiest air terminal, more than 120 transports, not including private and military aircraft, land and take off every 24 hours. The four companies located at the field, United Airlines, Eastern Airlines, American Airlines, and Transcontinental and Western Air accommodate more than 1,200 passengers daily.

Transport plane provided with slinger ring de-icers

—AERO DIGEST

To the air traveler, as well as to the man on the street, an airline is merely a collection of ships, pilots, stewardesses and passenger agents. Little do they know that in spite of its sprawling routes it is a highly integrated unit closely connected by a network of communications almost as intricate as the nervous system of the human body. On the large lines there are about 15 to 20 employes at work for every passenger aloft. Of these the traveler sees but a few. Most of this unseen force he passes by unknowingly.

Characteristic of the hidden manpower of an airline are the men who handle affairs at the scattered intermediate airports along the routes. United Airlines maintains such an outpost at the little airport of Kylertown, Pa., high in the Allegheny mountains. Here the UAL planes on the Newark-Cleveland route contact the ground for weather reports and sometimes drop in for fuel when the headwinds are strong. These intermediate fields, equipped for that and any other possible emergency, are run by a station manager, two mechanics, and two radio operators.

Scattered throughout the country at these intermediate fields are some 200 UAL employes, a small fraction of the total force of 1900 needed to handle the more than 220,000 passengers UAL will carry this year and to run a fleet of ships which will shortly comprise 30 Boeings and 28 new Douglases, the latter representing an investment of $3,000,000.

Of the 1,900 UAL employes, only 150 pilots and a like number of stewardesses constitute the flying personnel. They, and a couple of hundred passenger agents, form the group the passengers see. Another 450 employes man the main overhaul shops at Cheyenne, Wyoming. There are radio operators, dispatchers, meteorologists and mechanics at all the fields where scheduled stops are made. In addition, the company maintains a staff of research engineers and technicians who are constantly at work on new improvements, and a number of press agents and publicity men as well as a regular office staff.

The Department of Air Commerce regulations permit transport pilots to work a maximum of 100 hours monthly. Four to four and a half hours a day—that is their average—doesn't seem like a lot of work, but four hours of flying passengers, with the responsibility involved, is worth easily eight hours of anything else. For this a first-pilot receives a base pay of between $2,200 and $3,000 a year plus an additional sum computed on the number of daylight and night hours of flying he does. Thus, most receive somewhere in the vicinity of $7,500 annually. A co-pilot's pay is standardized at $2,700 a year.

The stewardesses, the ones who help make the trip interesting, must, by company policy, be registered nurses. They must be attractive, intelligent, competent, not more than 120 pounds in weight and less than 30 years old. In flight, these girls distribute reading matter and food, converse with passengers, answer questions relating to the trip and in general try to make it seem as brief as possible. Before the flight the stewardess must see to it that she has box lunches for each passenger, thermos bottles of coffee, cigarets, paper slippers for passengers wishing to remove their shoes, post cards, stationery, chewing gum, magazines, playing cards, newspapers and time-tables as well as the company forms to be filled out en route. Her own personal effects, which include a kit of medications, must be as light as possible. A stewardess receives $125 a month and expenses away from home.

The dramatic part of an airline naturally is in its actual operations. So look for a moment behind the scenes into the operations room of an airliner at one of the larger airports. Radio operators are hard at work at one end and the meteorologist is busily going over his charts. At the end of a long desk in the center of the room are racks containing company instruction and notices for pilots from the Bureau of Air Commerce. On one wall is a large map of the company's route with little tags showing the position of their various planes in flight. Directly below this are large weather maps, prepared at eight hour intervals and put in a binder for ready reference.

At approximately an hour before departure time the pilot, co-pilot and stewardess report to the operations room. The stewardess merely receives her weather report for the flight and then goes on to check her equipment. The pilots, however, spend most of this time conferring with the company meteorologist. Together they carefully study the weather maps and charts and plan the details of the flight accordingly. When this trip forecast is signed, the permission of clearance is automatically obtained for the first leg of the journey.

By this time the plane has been wheeled out of its hangar and the mail and baggage packed safely away in the nose of the ship. The pilots climb into their cockpit, start up the twin motors, look over the controls and wait for the passenger agent's signal that everyone is aboard. Mechanics pull the blocks out from under the wheels and the big ship taxies slowly away from the hangar to the end of that runway which faces most directly into the wind. When the operator in the traffic control tower signals that all is clear, the pilot gives his motors the gun and the big ship roars down the runway for the takeoff.

As the plane flies its course it is guided constantly by the radio direction beams along the route, and by radio conversation with ground stations. Every possible aid to safety is employed by the operating companies and well equipped experimental departments are maintained to develop more. United Airlines planes are checked after each flight and thoroughly examined after 20 hours of actual flying. After 120 hours (these figures may vary slightly on other lines), a still more exhaustive check is made, while at the end of 500 hours the ship is sent to the main shops at Cheyenne, Wyoming, where it is disassembled and practically rebuilt from the wheels up.

As said before, the airlines each maintain their own experimental laboratories, where technicians are constantly at work on some new safety device. One of their most timely and useful developments is the de-icing equipment which prevents ice from forming on the propeller and wings. Tremendous improvements have also been made on aircraft radios. Experiments are now under way to develop a new electrical system which will permit the use of electric stoves, irons, and other appliances without requiring extra batteries. Air-conditioning units have been in use on most lines for some time now.

Little has been said about the press agents and publicity men employed by the airlines. These men, whose duty is to keep before the public eye the name of the company they represent, are tireless in their efforts to overcome the biggest obstacle in the path of commercial aviation, the widespread belief that flying is dangerous. Approximately 80 per cent of the American people have never been up and a still larger percentage have never flown in a commercial transport, partly because the public is always skeptical of anything new. But now, with four-motored clipper ships spanning the oceans, with giant transports crossing the continent overnight, and with new, faster, forty-passenger planes soon to make their appearance, there is good reason to believe that commercial aviation will continue to break down that barrier of fear and, before long, become the major means of long distance passenger transport.

Some Problems of Rural Electrification *

by **JOHN A. BECKER**

Director, Rural Electrification Coordination in Wisconsin

MY SPEECH has rather an imposing title. It's quite in keeping, I might add, with the imposing problems which have faced the government in its venture of rural electrification on a large scale. A good many of those problems have been licked, but we are still holding our breaths as we go around some of the new curves in the road for the first time.

What REA Is

As most of you probably know, the Rural Electrification Administration is directing a 10-year self-liquidating program whose purpose is to bring electricity to farmers at rates they can afford to pay. REA is a financing organization that lends money on equal terms to all agencies in a position to carry through a power line construction project rapidly and adequately. More than 90 per cent of all REA applications have been from farmer electric cooperatives.

This is a paper presented at the Engineering Society of Wisconsin 1937 Convention in Madison, March 4-5.

Wisconsin's REA Program

In October, 1935, Governor La Follette established the Rural Electrification Coordination to help Wisconsin farmers obtain their share of federal funds allocated for rural electrification purposes. Wisconsin is now foremost among the 48 states in its total allocation of $3,613,600 in federal REA funds to build about 3,500 miles of rural electric lines and thereby bring electric service to nearly 12,000 farm homes. Approximately 25,000 Wisconsin farmers have signified their desire for electric service from REA-financed lines.

By spring of this year, more than 1,500 farmers in Richland, Columbia, Dane and Dodge counties will be able to use high electric service on their farms for the first time. These projects will have the distinction of being the first REA projects built in the state.

Organizing Projects

These few facts should establish the interest Wisconsin farmers have in REA projects. They have waded through snow to preliminary organization meetings, offered their unlimited services without compensation, remained loyal to their co-ops. They not only want electricity but are determined to get it.

So far, they have overcome that initial economic difficulty. Farmers have no funds for organization work. Their own interest has stimulated the formation of their cooperatives, and farmers have voluntarily contributed their time and their automobiles in laying the groundwork for a project. The Coordinating office was able to help them by sending our speakers to explain the details of the REA program and to advise them of important steps in forming a rural electric cooperative.

In connection with the tremendous REA organization job which has been done in this state, I want to mention the wonderful assistance farmers have had all over the state from county agricultural agents. A good many of our best projects are those which have been formed under the leadership of county agents.

Preliminary Engineering Survey

When the interest and meetings in a rural community have signified a serious interest in forming an REA project, the Rural Electrification Coordination engineering staff has made a preliminary survey of the territory and prepared loan application for submission to Washington.

Economic Feasibility of REA Projects

One of the major considerations in selecting projects for development is economic feasibility. The development of a project is not just a matter of sending an application to REA in Washington. Let me emphasize that REA is a business proposition. Will the project pay out? What is the general caliber of the farms in the project? What is the average yearly income? How strong is cooperative loyalty and leadership in the group? What is the average cost rural residents are willing to pay for electric service a month? What appliances do residents expect to purchase? How many potential customers own their own farms? What is the average density per mile? These are some of the questions considered in the examination of a project.

It does not pay to organize cripples. There is something more at stake than the failure of an individual project. The financial collapse of a rural electric cooperative would have an extremely serious depressing effect on the cooperative rural electrification and public ownership programs throughout the entire country.

Average Farm Income

I believe we are very fortunate here in Wisconsin. We know that the average cash income for a United States farmer in 1935 was more than $1,000. It is fair to assume that the average income for the Wisconsin farmer was higher than that because of the state's dairying industry. With the general improvement in financial conditions during the past year and the state's present promotion of dairy products, there is every indication that the Badger farmer's yearly income is well over $1,000.

WERA Survey

To aid our organization in studying the economic feasibility of REA projects, we have the results of a detailed rural electrification survey made in the state by the Wisconsin Emergency Relief Administration in 1935. Mr. E. B. Wayts, the chief engineer of the Wisconsin Rural Electric Cooperative Association, was associated with that splendid project. The survey covers all but the most urban counties and contains an invaluable amount of material on the density and caliber of farms, conditions of roads, number of industrial plants.

Size of Projects Important

Our experience in the Rural Electrification Coordination office during the past year has led us to believe that small REA projects should in most instances be discouraged because they have the least prospect of developing a sufficient consumption of electric energy to make their projects profitable. This statement, of course, is not true in all instances, depending on the density of the project, the wholesale rate available, and the average consumption contemplated by individual customers.

Feasibility and Wholesale Rates

Just a word about the problem of rates. We believe that electricity should be sold under entirely different conditions than have been customary in rural areas. For instance, Rural Electrification Coordination feels that any sort of service charge which does not include some current should be avoided in billing farm customers. Room and area changes are not suitable to ordinary farm service and are out of date. This office recommends a simple system of block rates with a promotional rate schedule. Higher use is induced by having the price per kilowatt hour drop sharply in the second and following blocks of the schedule.

The wholesale rate problem is very important because it goes far in determining the feasibility of a project. REA recommends a wholesale rate which averages 1.5 cents per kilowatt hour and has a bottom price of not more than 1 cent per kilowatt hour.

The matter of reasonable wholesale rates has been one of our chief problems in Wisconsin. While the Public Service Commission issued orders in the spring of 1936 requiring the six largest private utilities in the state to file wholesale rates for REA cooperatives, only one project is being served by a private utility. Municipally owned utilities, however, have cooperated full-heartedly with the program and are, wherever possible, supplying projects with wholesale energy.

Building on Community-Wide Basis

A vital economic policy of the Rural Electrification Coordination is an orderly development of electric service. We believe that rural electrification can be accomplished most economically on a community-wide project basis rather than by building short extensions in scattered places —as has too often been the practice in the past. We are not interested in hurting anybody. We are interested in building for the common good. The REA cannot duplicate existing service, but it will make a fight to prevent the power compaines setting up lines that serve only the most accessible customers in an area where an REA project has been outlined to serve them all. Private utilities have been asleep at the switch too long.

Suggestion for the Future

I have pointed out that the REA projects in this state have been organized through the enthusiastic work of farmers themselves. Fortunately the Rural Electrification Coordination office has been able to assist them in their promotional work by sending out, at their request, speakers, engineers, and informational material and later analyzing projects so that they would be submitted to Washington in the best possible shape.

Under the Wisconsin statutes a non-profit corporation can spend only 5 per cent of its membership fees for operation expenses. Since the membership fee of most REA cooperatives in the state is only $5, and sometimes as little as $3, there is a negligible possibility of utilizing such funds for organization work. In the future it might be desirable for cooperative members to contribute a certain sum which could be used for local promotional and educational activities.

"Statewide"

Since a state agency cannot enter into contracts with the federal government, the Rural Electrification Coordination office has confined its work to promotional and educational activities. To assist local cooperatives with engineering and other problems after allotments have been granted by REA, the Wisconsin Rural Electric Cooperative Association was organized in April, 1936, by REA cooperatives in the state. This Association, or "Statewide" as it is familiarly called, is a cooperative of cooperatives.

Although the Coordination and "Statewide" are separate organizations, they work in very close cooperation. In fact, their work is so closely interwoven that it is difficult for a person unfamiliar with the state rural electrification program to understand where the work of one leaves off and the work of the other begins. While the activities of the "Statewide" are confined at this time to engineering services because of lack of funds, there are many valuable central services which the organization could provide if finances permitted.

Operation

I have just outlined the major economic problems of the rural electrification program in the state up to this time. Construction of projects is an engineering problem, but operation is not. Here enters that intangible human factor which can so often make or break a venture.

Management

Each rural electric cooperative must have a manager. The cooperatives need men with some technical knowledge of rural electric lines, and a certain amount of knowledge of accounting and salesmanship. Unfortunately, there are few such men available at this time because there has been little training along these lines.

I cannot emphasize too strongly that REA projects must be operated on a strictly business basis. Rural electric cooperatives will have to give serious attention to prudent management if any kind of an electric power yardstick is to be set up in the state. They will have to determine what they are going to do about group wiring and group purchase of appliances in the hope of effecting economies. They will have to realize that they alone own their cooperative and that their success or failure is squarely upon their own shoulders.

Servicing

Another operating problem is that of servicing electric lines. Since REA projects are spread over a wide area, they are confronted with a problem municipal utilities do not know in their service of small compact areas. Since cooperatives, especially during their first years of operation, are going to be scrutinized carefully and curiously by private utilities and the general public, they will have to match private utility service in steadiness and efficiency.

Furthermore, we must remember that when a rural electric cooperative is energized, hundreds of rural customers are buying and using electric appliances for the first time in their lives. The cooperatives will have to service appliances and assist their members in the intelligent purchase and use of such appliances.

Load Building

This brings me to one of the most formidable operating problems facing rural electric cooperatives. That is the educational job of building rural loads. The success of REA cooperatives can come only through building their loads and making money for their members as well as increasing their comfort.

The question is: can it be done? We believe that the electric program, like all other farm programs, is a matter of development throughout the years. We cannot expect even the more prosperous farmers to add all the best electric appliances during the first year.

At the present time, not including household operations, there are over one hundred uses of electricity that have resulted in tangible money uses or money saving enterprises on the farm, uses that make electricity highly profitable and services that would cost considerably more in any farm other than electric. Not all of these uses would be applicable to any one farm but enough are applicable to make electric service a self-sustaining proposition.

When a farm group demands farm electrification, do they really mean it, or are they thinking merely of farm lighting? Electric lighting is not farm electrification; it is a very important part of farm electrification, but hardly important enough to justify all the costs involved. Farm electrification is the use of energy in sufficient quantity to justify the building of the line and the wiring of the buildings. An electric line is good for only one purpose, transmitting energy, and if it fails in that respect, it is a liability.

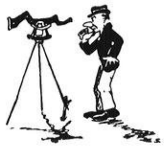
We in the Rural Electrification Coordination know that. I believe that those of you who have had any experience

(Continued on page 121)

ON THE CAMPUS

NYA NOTES

From month to month as we run around the campus, we'll try to bring you a more or less definite idea of just what the engineers working on NYA jobs are doing.



Don't, first of all, get the idea that the jobs are anything like the WPA or other alphabetical jobs which have become the butt of many jokes as to their labor content. According to the instructors for whom these boys work, they are doing difficult jobs well, and are really accomplishing big things.

First stop was the E.E. lab, where we found some of the busy electricals calibrating electrical instruments and recording devices; doing repair work on the watt hour meters which will go into the exhibit in the E.E. lab; designing an optical system for the Taylor Reflectometer for measuring the light reflection coefficient of paints; rearranging the lab circuits and storage batteries; also doing expert cabinet making in adding to the furniture supply.

Next we found eleven civils working under Professor Owen of the T.E. department on a local control map of Madison and the vicinity. They are completing two loops started by the CWA under the United States Coast and Geodedic Survey around Lake Monona and Lake Mendota. The CWA left the traverse unfinished and also many errors to be corrected. The original traverse is being finished; the errors corrected; elevations, coordinates, descriptions, and azimuths being laid out.

That's all for this month, but next month we'll bring you a survey of the engineers working in the structures and mechanics departments.

DRAWING CONTEST IS GAINING MOMENTUM

The fourth annual **Wisconsin Engineer** drawing contest, sponsored by Alpha Tau Sigma, is rapidly getting under way, with all indications pointing to a record number of entries from the freshman drawing classes. This year's contest represents a departure from those of previous years in several ways. The first is that the drawing for the contest is one of the regularly scheduled drawings in the freshman course. Thus very little outside work must be done by those wishing to enter. Another point is that the problem is quite a bit more difficult than its predecessors. The aim of the department is to include as many of the standard conventions as possible, such as sections, threads, etc. Another proposed change, which is not definite as yet, is to delay the announcement of the winning drawings until the first issue of the **Engineer** in the fall. This would give the entrants more time to work, and also give the judges a better chance to make their choice.

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PROF. WITHEY HOME FROM EASTERN CONVENTIONS

From February 17 to March 1, Prof. M. O. Withey of the mechanics department was in the eastern section of the country attending two conferences on materials and construction. The first was a meeting of the committee to make plans for the annual meeting of the American Society for Testing Materials to be held in Philadelphia. In New York City he attended a meeting of the American Concrete Institute.

C. A. Willson, c'21, also attended. At the present time he is a structural engineer with the state architect, and previously he taught structures here at the university.

MRS. OWEN THROWS A PARTY!

Members of Prof. Ray S. Owen's T.E. 104 class were the guests of Mrs. Owen on Saturday afternoon and evening, February 27. Entertainment took the form of hockey, ice-boating, ice basketball, movies and cards. About twenty-five delighted civils accepted the invitation to the Owen bungalow on Lake Monona. According to the best of advance reports, Mrs. Owen's mince pies were to be the high light of the afternoon, with Professor Owen's movies of the recent flood in Indiana running a close second.

The party was originally scheduled for February 13, but was unavoidably postponed because of the extremely warm weather.

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WE BEG YOUR PARDON

Through some unknown error the name of Evan H. Shuette was left off the freshman honor list in the February issue of the **Engineer.** He earned a total of 53 grade points with 18 credits, which gives a grade point average of 2.944. This places him at the head of the honor list with Robert J. McCarter, who also had a grade point average of 2.944.

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RETIRES FROM ACTIVE SERVICE

Frederick W. Doolittle, vice-president of the North American Company, New York City, and officer and director of several of its affiliated companies, has retired from executive work. Mr. Doolittle was at one time professor of mechanics here at the university.

Use of AERIAL PHOTOGRAPHS *in the Coon Valley Area* *

by M. F. SCHWEERS

Field Director, United States Soil Conservation Service

BEFORE discussing the use of air maps in the Coon Valley demonstrational area, it seems logical that a resume of the soil conservation program be given as a background.

The objectives of the program devised and undertaken by the Soil Conservation Service are: (1) to demonstrate that the impoverishment and destruction of our remaining areas of good agricultural land by continuing soil erosion can be curbed, and (2) to lay the foundation for a permanent national erosion-control program of adequate scope to meet the acute land crisis created by wasteful methods of land utilization.

To carry out these objectives, the Soil Conservation Service has, since its inception in 1933, spread its network of demonstration watersheds and camps throughout the United States until now there are 156 such demonstration projects and 450 CCC camps engaged in soil erosion control work. There are three demonstration areas and 17 CCC camps located in the non-glaciated area of southwestern Wisconsin. The demonstration and camp areas carry on similar programs, the extent of the work area being different. In the demonstration areas the work is limited to a single large watershed, whereas in the camp areas the work is carried out on farms lying within a 12-mile radius of the camp. An effort is made to secure cooperators grouped within small scattered watersheds, but cooperation with scattered farms for demonstration purposes is included.

The Coon Creek project of the Soil Conservation Service was the first demonstration area set up by this service in the United States and includes portions of Vernon, La Crosse, and Monroe counties in southwestern Wisconsin. The project area of 92,000 acres is representative of approximately 12,000,000 acres comprising the non-glaciated portion of the Upper Mississippi Valley. This non-glaciated region is characterized by steep slopes and very erodible soils which, along with inadequate erosion control practices, have made this one of the seriously eroded agricultural sections of the entire country.

The greater part of the project area occupies a deeply and thoroughly dissected upland. The valleys are comparatively narrow and steep sided, the ridges are gently rolling to rolling and vary from broad in the east portion to very narrow in the west. There is a considerable variation in elevation in the area, varying from 1,362 feet at Cashton on the east end of the area to 646 feet at Stoddard, the western end of the demonstration area, a distance of approximately 23 miles. A difference in elevation of from 300 to 500 feet between the ridge and valley land is common, especially west of the village of Coon Valley.

The program as carried out in the Coon Creek area and other project and camp areas involves the following general policies: (1) Steeper slopes are retired to permanent timber in which grazing is not permitted, and replanting to trees is done on the denuded areas in these retired woodlots; (2) terracing is used on moderately sloping ridge fields that are adapted to terracing and where suitable terrace outlets are available or can be provided, in order to decrease sheet erosion and stop small shoe-string gullies; (3) steeper cultivated slopes are retired to permanent pastures and to permanent hay; (4) strip-cropping is done, which consists of planting alternate contour strips of a dense growing hay crop with cultivated or grain crops on those areas where short rotations are advocated or necessary. A combination of terracing and strip cropping is advocated for terraced fields in rotations; (5) the control of gullies and eroding stream banks is done by using suitable structures.

At the present time there are 43,299.9 acres involving 413 farms under cooperative agreement. These farmers have signed five-year agreements in which thy agree to follow the plans for improved practices formulated by themselves and the representative of the service. This involves the making of maps showing the fields of the farms and giving sufficient supplemental information so that there is no doubt as to the provisions made under the mutual agreement. As a result of the programs on these farms the following practices have been inaugurated:

Practice	Acreage
Retired Woodlot	12,387
Permanent Pasture	11,853
Permanent Hay	7,012
Strip-Cropped	7,594
Terracing (some areas are also strip-cropped)	1,768
Flat and Waste Lands and Farmsteads	remainder

As previously mentioned, it is necessary that maps be prepared for all farms showing fields, acreages, etc., and the use of aerial photography has been found to be most valuable in this work. Without it, necessary basic information of large areas could not possibly have been ob-

*This is a paper presented at the Engineering Society of Wisconsin 1937 Convention in Madison, March 4-5.

tained within the time limits necessary and with the funds which have been available.

With aerial photographs large areas can be covered rapidly, critical areas established, and ground work begun within a short period of time, whereas with ground survey methods the critical areas can be determined only after long-period surveys. In addition to the speed with which they can be obtained, aerial photographs facilitate land classification and mapping work because of the very large amount of recognizable detail which they supply and are less expensive than maps prepared by ground methods. Air maps for the Coon Creek area cost $1,369.57, or an approximate cost of 1.5 cents per acre.

When used as field sheets, the large amount of detail appearing within aerial photographs makes it possible for the surveyor recording field conditions to locate himself within a few feet on the photographs merely by visual inspection without the use of planetable intersection. This speeds up the rate at which field recording can be accomplished.

The air map is first used by the soil surveyor after the farmer has signified his intention to cooperate in an erosion control program. The surveyor goes over the farm and indicates on the map the following information: (1) type of soil, (2) degree of erosion, (3) slope, and (4) soil cover. With this land inventory before him it is possible for the soil conservationist to work with the farmer and

Typical Aerial Photograph

plan a comprehensive agricultural program. He uses another base map and, with the information on the conservation survey air map, goes over the farm with the farmer and determines which areas are to be retired from grazing, which areas should be seeded down, which areas are to be terraced, and which areas are to be strip-cropped, etc. They also discuss rotations and after a general plan has been formulated, the conservationist uses a hand level and scale and draws in the field areas, indicating the location of terraces which are to be embodied in the farm program, shows the probable location of structures, of wild life food patches, etc., on the air map.

After a definite plan has been agreed upon, each field is given a number for reference purposes. The acreages of all fields are determind by the use of a planimeter and a five-year cropping plan is agreed upon.

By referring to the attached photograph, a typical farm plan may be visualized. In reviewing the map it will be noted that the fields are all designated by a number within a circle and either to the right or below that circle, the acreage of that field is given. It will also be noted that there are letters in each of the fields, the legend as used on this particular farm being as follows:

R — Rotation
P — Permanent pasture
H — Wild life food patch in field
U — Ungrazed
W — Woodlot
F — Forest to be planted

In order to become acquainted with the set-up, it might be advisable to refer to a series of fields, for example: 36 - 37 - 38 - 39 - 40. We will assume that on this particular farm these fields are in a five-year rotation and the cropping system might be as follows:

Field No.	36	37	38	39	40
Acreage	2.3	2.3	2.3	2.7	3.7
Year					
1937	Corn	Alfalfa	Grain	Alfalfa	Alfalfa
1938	Grain	Alfalfa	Alfalfa	Corn	Alfalfa
1939	Alfalfa	Corn	Alfalfa	Grain	Alfalfa
1940	Alfalfa	Grain	Alfalfa	Alfalfa	Corn
1941	Alfalfa	Alfalfa	Corn	Alfalfa	Grain

Similar plans are provided for all fields in the farm program.

In closing, it would be well to emphasize the fact that aerial photographs of quality showing all possible culture details, field boundaries, drainage, type of land use, etc., are coming to be more and more essential in all work relating to the use of land. It is hoped that aerial photographs and maps will be available for all critical areas before programs directed toward correct land utilization, conservation of natural resources, and flood control are put into effect. It would seem obvious that such programs must be dependent upon the fullest knowledge of the conditions of the land and its natural resources. Not only are such maps essential to land utilization and conservation work, they also will repay their cost many times over in direct benefit to the owners of the land, users of land, taxing bodies, engineers and all persons or organizations whose work in any way relates to or is dependent upon a knowledge of what actually exists in any land area.

AT THE CONVENTION

ROBERT C. JOHNSON of Fond du Lac was elected president for the ensuing year. Bob, who for many years was chief engineer for the Immel Construction Company, is at present assistant to the state director, NEC. To old timers, Bob will always be "the son of Dean J. B. Johnson, who created the College of Engineering at Wisconsin." To his own generation at college, he will be remembered as a lieutenant of engineers in the more or less famous expedition to Archangel on the White Sea during the World War. To the present generation, he will be remembered for his work as state director of CWA in 1933 and as candidate for the nomination as lieutenant governor. He is a member of the Wisconsin Registration Board of Architects and Professional Engineers.

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Christopher A. Wiepking of Milwaukee was made vice president. Chris is head of the testing laboratory for the City of Milwaukee. Readers of the **Wisconsin Engineer** may remember him as editor of this journal during his student days.

C. A. Wiepking

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Harold S. Tuttle of Eagle River and Otto C. Rollman of Green Bay were elected as the new trustees. H. O. Lord and C. A. Willson of Madison are the hold-over trustees.

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Cedarburg and Fennimore were reported to have begun the system of sewer service rentals in October of 1935. Oshkosh, Racine, Monroe, and Fond du Lac are said to be considering the introduction of the system, which has been adopted by some 400 cities in the United States. The enabling act was passed by the legislature some years ago to eliminate the argument raised by some cities that they could not introduce sewage treatment because they had reached the limit of their bonded indebtedness. The Supreme Court, in the Racine case, has held the sewage rental system valid.

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Clear roads and balmy weather united to induce many engineers to trek to Madison for the meeting. There were 143 registrations. Attendance was swelled by the many students who dropped into the meetings when classes would permit.

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Simultaneous group meetings were held during the morning sessions. The afternoon sessions were general meetings. This plan resulted in there being a smaller number at one group meeting than would otherwise have been the case, but permitted of greater variety in the program. The trustees are determined to widen the appeal of the meetings if such a thing be possible.

The main attraction of the meeting was Jean Piccard, stratosphere explorer, and his wife, Jeannette, who piloted his balloon in the Detroit flight in 1934. They both spoke at the joint banquet with the Technical Club on Thursday night and before an audience of students on Friday morning. Student interest was about equally divided between the story of the design of the gondola and Prof. Piccard's ability to draw diagrams with both hands at once.

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Rural electrification in Wisconsin is proceeding on a ten-year self-liquidating program. Already $3,613,600 has been allocated for 3,500 miles of rural lines serving 12,000 farm homes in Wisconsin, according to John A. Becker, rural electrification coordinator for Wisconsin whose paper was presented by his secretary, Mr. Olaf Johnson. Ninety per cent of applications have come from co-operatives. Municipal utilities have co-operated wholeheartedly in the movement, according to Mr. Becker, but only one private utility has contracted to sell current to a rural co-op.

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Henry H. Tubbs, for many years a regular attendant at the society meetings but now 86 years old and bedridden, was made an honorary life member. During his early days he took an active part in building the railroads of the state. More recently he has been city engineer at Elkhorn.

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The convention approved a motion to appoint a committee to prepare a plan for co-ordinating the engineering societies of Wisconsin. Registration of professional engineers in the state has proceeded to a point where the profession is beginning to crystallize out of what has been a rather murky solution. The need of integrating the individual engineers into a consolidated profession is becoming plainly apparent.

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State registration of water works and sewage plant operators was approved in a resolution supporting a bill for that purpose now in the legislature.

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A new note was introduced at the meeting by the presence of a priest-engineer, Father Claridge of St. Nordbert College, at West De Pere, who proved himself to be interesting as well as interested.

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Society membership decreased during the year from 347 to 313. New members numbered 38 and those dropped from the rolls for non-payment of dues numbered 65.

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The symposium on modern transportation, Thursday afternoon, was enlivened by Mr. Frank Newell's story of the wealthy old bachelor who wanted to marry so that he might have an heir. "I wouldn't advise it," his physician said, "you are heir-minded but not heir-conditioned."

ALUMNI NOTES

Alumni in the Soil Conservation Service, U. S. Department of Agriculture, Wisconsin

ANGOLI, L. E., c'32, is working on the engineering staff of the Soil Conservation Service at Argyle, Wis., CCC camp.

BEHRENS, HAROLD, c'33, is senior engineer in charge of construction and design at the SCS CCC camp at Argyle, Wis.

WHITE, OMAR W., c'23, is camp superintendent of the CCC Soil Conservation camp at Argyle, Wis.

BURMEISTER, WALTER, c'33, is on the engineering staff of the Soil Conservation CCC camp at Mount Horeb, Wis.

LYNEIS, CLAUDE A., Jr., c'33, is camp superintendent of the Soil Conservation Service CCC camp at Highland, Wis.

SHERBURNE, M. J., c'34, is senior engineer in charge of construction and design at the Soil Conservation CCC camp at Highland, Wis.

OTTENSMAN, C. W., c'33, is senior engineer in charge of construction and design at the Soil Conservation CCC camp at Platteville, Wis.

BRINKMAN, LORIS B., c'35, is on the engineering staff of the Soil Conservation CCC camp at Platteville, Wis.

WEBSTER, DONALD W., c'33, is senior engineer in charge of construction and design at the Soil Conservation CCC camp at Bloomington, Wis.

J. C. TRIELOFF, c'33, is senior engineer in charge of construction and design at the Fennimore project demonstration area at Fennimore, Wis.

ERICHSEN, FRANK P., '32, is travelling supervising engineer for the southern part of Wisconsin, working for the Soil Conservation Service with headquarters at Fennimore, Wis.

LANDWEHR, E. A., c'28, is camp superintendent of the Soil Conservation Service CCC camp at Gays Mills, Wis.

AMUNDSON, CARL, c'34, is with the engineering staff at Gays Mills, Wis., working for the Soil Conservation Service.

PETERSON, E. J., c'31, is project manager of the Soil Conservation Service demonstration area at Independence, Wis. Mr. Peterson has charge of the northern CCC camps on soil conservation in Wisconsin.

WHEELER, EARL W., c'32, is camp superintendent of the Soil Conservation CCC camp at Ellsworth, Wis.

RASMUSSEN, WALTER, c'33, is senior engineer in charge of design and construction at the CCC Soil Conservation camp at Ellsworth, Wis.

REINKE, R. E., c'28, is camp superintendent of the CCC Soil Conservation camp at West Salem, Wis.

TOURVILLE, C. W., c'31, is camp superintendent of the CCC Soil Conservation camp at Ontario, Wis.

THURNER, GEORGE, c'33, is senior engineer at the CCC Soil Conservation camp at La Valle, Wis.

ROBBINS, FRANCIS, c'33, is senior engineer in charge of design and construction at the CCC Soil Conservation camp at Coon Valley, Wis.

WHITE, EMIL, c'22, is senior engineer in charge of construction and design at the CCC Soil Conservation camp at Viroqua, Wis.

SOWLS, HOMER, c'31, is senior engineer in charge of design and construction at the CCC Soil Conservation camp at Dodge, Wis.

McMICKEN, ROBERT, c'33, is senior engineer at the CCC Soil Conservation camp at Menomonie, Wis.

WOLFF, R. E., c'31, is camp superintendent at the CCC Soil Conservation camp at Black River Falls, Wis.

SMITH, HAROLD E., c'32, former captain of the Wisconsin football team, is camp superintendent of the CCC Soil Conservation camp at Nelson, Wis.

MINSHALL, NEAL E., c'24, is chief engineer in charge of all erosion control design and construction in the state of Wisconsin. Offices in La Crosse.

REE, WILLIAM O., c'35, is in the design office of the Soil Conservation Service at La Crosse, Wis.

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Mechanicals

KUSTER, ARTHUR L., '36, recently with the Four Wheel Drive Co. of Clintonville, Wis., has accepted a position with the Taylor Instrument Co. of Milwaukee.

COOK, EUGENE, '36, and **FULLER, HENRY B.,** '36, have changed from the A. O. Smith Co. to the Allis-Chalmers Mfg. Co., where they are employed in the turbine department.

GUNTHER, LAWRENCE, '36, is starting work with the Berlin Chapman Co., manufacturers of canning machinery, located at Berlin, Wis.

KOLLER, HARRY, '36, has been transferred to the Milwaukee office of the Trane Co., Milwaukee, Wis.

HORNECK, CARL, '37, has very recently received an attractive offer from the Dunham Co. of Michigan City, Ind.

HEMBEL, D. W., '32, has started as drafting and designing engineer at the Barber Colman Co., Rockford, Ill.

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Electricals

FERRIS, W. H., '31, is with the Wisconsin Power and Light Co.

BENNETT, ROBERT, '36, has a position with General Electric, Schenectady, N. Y.

KERN, P. H., Jan.'37, is working at the Hawthorne Station, Western Electric Co., Chicago.

KUEHN, FRED, '36, is engaged in transformer design at the General Electric plant in Pittsfield, Mass.

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Chemicals

BONE, WINSTON, W., '34, has quit his WPA job to take a position with the Berlin Mills, Berlin, N. H., manufacturers of paper.

GEISSMAN, THEODORE F., '30, expects to get his Ph.D. degree in June from the University of Minnesota; his major is organic chemistry.

HOERIG, HERMAN F., '34, quit his job with Goodyear Tire and Rubber Co. to join the instructional staff in chemical engineering.

JANETT, LESLIE, '35, former editor of the **Wisconsin Engineer**, is in Houston, Tex., on a job for the Ross Engineering Corp., Chicago.

WRIGHT, JOHN F., '36, has been transferred from Elizabeth, N. J., to the Development and Research Division of the Standard Oil Company of Louisiana, Baton Rouge, La.

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Wisconsin Fliers

The following information has been received from Lt. E. L. Johansen, U. S. N. R. in regard to Wisconsin engineers who have taken or are taking training as fliers in the U. S. Naval Reserve:

BURDICK, WILLIAM E., ex-m'30, is a lieutenant, U.S.N.R., with the Sikorski Aircraft Corp., Export Division, European Branch.

CASE, CLINTON D., m'29, is a lieutenant, U.S.N.R., and flight officer instructor in ground school at Naval Air Station, Pensacola, Fla.

HOLLENBECK, HENRY C., ex-m'25, is a lieutenant, U.S.N.R., and first pilot for National Parks Airways, flying from Salt Lake City, Utah, to Great Falls, Mont.

OLSTAD, ORVILLE A., c'35, is a cadet now in training at Pensacola.

PENNOYER, JOHN H., ex-e'36, is a cadet. He has completed training at Pensacola and is now assigned to fleet squadrons.

RANDECKER, VICTOR W., ex-m'32, is a lieutenant, U.S.N.R., and co-pilot on the United Airlines on the Chicago-Newark Division.

UPSON, RICHARD C., ex-e'32, is a cadet. He has completed training at Pensacola and is now assigned to fleet squadrons.

"Dear Dean—"

By ENGIN EARS

My Dear Dean,

I note that preparations are being made for the annual Engineers' Parade in the near future. I sincerely hope that this affair will be carried through without the ill feeling between our respective departments that has occasionally marked its progress in past years. After all, it is a display of undergraduate high spirits and a fine old tradition.

Respectfully yours,
Lloyd K. Garrison
Dean, Wis. School of Law

Dear Dean,

I wish to concur heartily with your sentiment. I am sure that the fine cooperation existing between our two schools will make this year's parade one unmarred by unsavory incidents such as have occurred almost yearly throughout the past decade. Boys will be boys, of course, but the tossing of eggs about the Engineering lobby, as per last April, does exceed the bounds of good taste and must not be encouraged. I am sure we will not see such acts repeated.

Yours very truly,
F. E. Turneaure
Dean, College of Engineering

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Dear Dean,

I note with some misgivings the point of your last letter. I regret to say that I really can't be personally responsible for the conduct of my undergraduates, at least, under such extenuating circumstances as prompted the incident to which you refer, viz., the precipitation into Lake Mendota of those 12 second-year Law students the previous night by a band of ruffian "engineers." This unwarranted attack roused so much feeling among the boys that I was, as you remember, unable to restrain them. While having no legal status, their action finds many precedents in the annals of our courts, which same, though not upholding the right of the aggrieved parties to the said action, acknowledge extenuating circumstances which mitigate the gravity of the offense. I would say that the responsibility for preserving the decorum of the event, the "parade," rests fully as much upon your department as upon mine. Hoping we are in accord on this matter.

Sincerely yours,
Lloyd K. Garrison
Dean, Wis. School of Law

Dear Sir,

I was somewhat surprised at the tone of your recent communication. To be quite blunt, the ducking to which you refer was occasioned by the sabotage of an Engineer float by a band of hoodlums who, I am sorry to state, turned out to be law students. Caught red-handed, they were accorded a justice far more speedy than that generally meted out in our so-called courts of justice.

Respectfully yours,
F. E. Turneaure
Dean, College of Engineering

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My Dear Sir,

At the risk of becoming personal, I must remind you that the root of the whole matter lay in the theft of a quantity of foodstuffs, to wit: eggs, feloniously and contrary to all civil and common law, stolen (and I use the word in the strictest sense) from the said plaintiffs. The natural act of the aggrieved in retrieving their own property, my dear dean, precipitated the entire series of events to which you allude. Even through the biased channels of engineering thought it must be apparent that such actions could never be swallowed passively by the red-blooded young gentlemen of the Law School.

Sincerely,
Lloyd K. Garrison, Dean

Dear Dean,

Admiring your bluntness, I am yet amazed at your belief in the credulity of the Engineers. We teach them to think, Mr. Garrison, not to memorize case books. Were my boys to suppose that those 19 cases of eggs, whose mean effective age was somewhat in excess of four weeks, were intended for some gigantic shyster omelet? They aren't dealing with L. & S. majors now.

Amusedly,
F. E. Turneaure, Dean

P. S. Since when have "young gentlemen" taken to law?
—F. E. T.

•

Dear Dean,

Your recent inflammatory note disturbed me considerably. I beg to state, sir, that I consider your tone and language an abuse of your office and faculty status. Your slurs upon my person I will pass over, considering the source of that criticism, but I will not have the students in my department referred to as "shysters." I believe we have had previous correspondence concerning this same subject. Law is an ancient and honorable profession not, I am glad to state, under the domination of flannel-shirted, oil-spattered ruffians. I trust our discussion of the matter is closed.

Icily,
Lloyd K. Garrison

My Dear Mr. Garrison,

I can see that our relations, as so many times in the past, have reached a critical stage. Being an engineer (and proud of it), I feel called upon to take personal exception to the charge of "ruffian" thrown out by any frock-coated reprobate. I await your apology and look forward with much anticipation to the "shellacking," if I may be permitted the word, about to be inflicted on certain SHYSTERS.

Frigidly,
F. E. Turneaure

•

Turneaure,

Speaking outside my official capacity, as I must assume you are, I assure you that no apology will be forthcoming. And it is my opinion that certain "plumbers" will rue the day they first flaunted their green flag before my apprentice attorneys. Why, any Law student can lick twice his weight in engineers. That goes for me, too.

Definitely,
Garrison

Garrison,

That, I take it, is a personal challenge. If you're man enough, we can settle this once and for all. Name place and time.

Turneaure

•

Turneaure,

Foot of ski slide; 8 tonight. It's taking advantage of my superior strength and build but you've long needed this lesson.

Garrison

Garrison,

Accepted, sucker. Bring your own arnica.

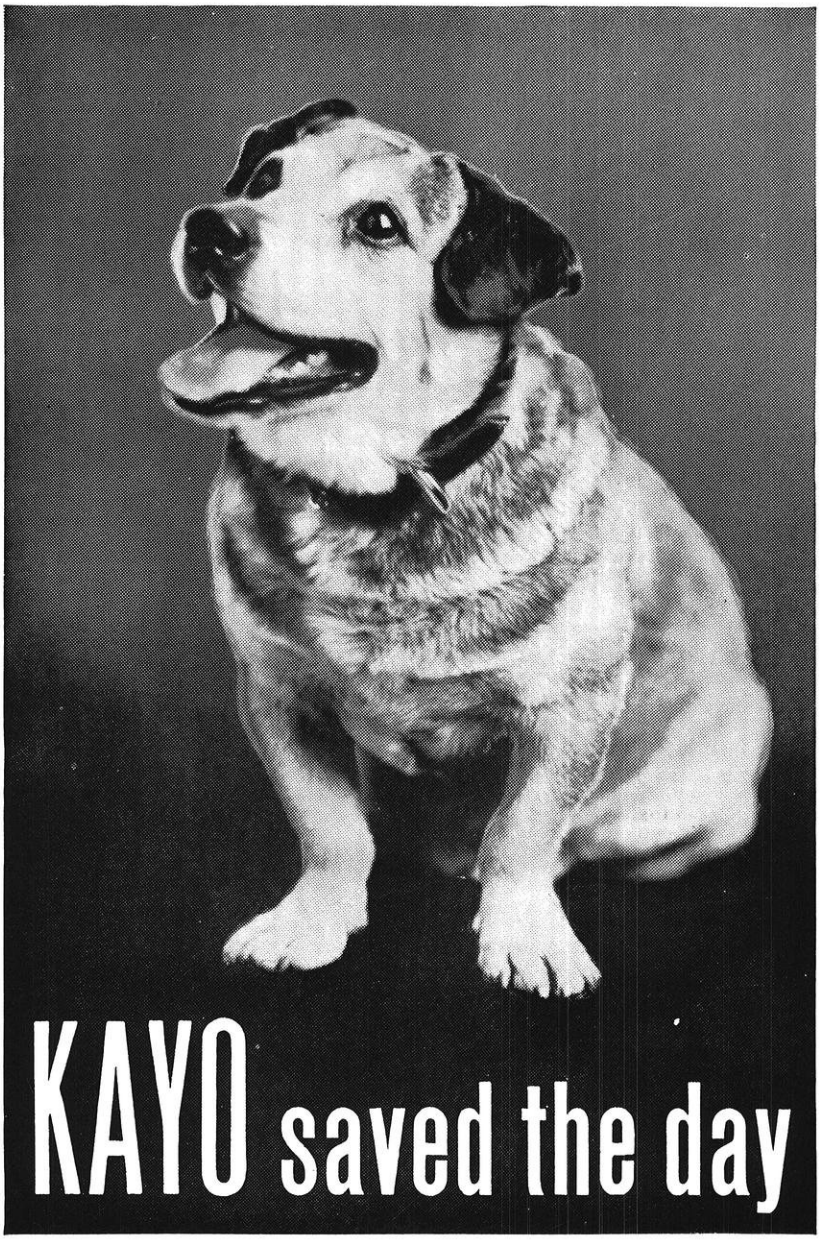
Turneaure

•

(from DAILY CARDINAL, page 2.)

"Dean Lloyd K. Garrison is resting well at the Wisconsin General Hospital after suffering lacerations of the nose and the loss of two teeth in a fall down the cellar stairs at his home last evening.

"Also victim of a household accident is Dean F. E. Turneaure of the College of Engineering, who suffered a lacerated ear, abrasions of the face and a sprained wrist as a result, he told reporters, of slipping on an icy sidewalk."



A CHURNING flood had taken out the telephone line across a Colorado stream. Repairmen couldn't wade it because of quicksand—couldn't cross elsewhere and bring back the line because of obstructions.

Then Kayo's master had an idea. He went upstream, crossed, came back and whistled. Kayo jumped in—swam across with a cord tied to his collar. With this cord, the wire was soon pulled over—communication was restored.

A small incident. But it typifies the ingenuity which helps Bell System men and women to give you the world's most dependable telephone service.

BELL TELEPHONE SYSTEM

Why not telephone home more often? Rates to most points are lowest after 7 P. M. and all day Sunday.

Air Conditioning of Railroad Trains *

by **F. O. MARSHALL**

Electrical Engineer, The Pullman-Standard Car Manufacturing Company

AIR CONDITIONING has been defined as "the simultaneous control of the temperature, humidity, air motion, and air distribution within an enclosure." When we air condition a home, an office, or a railway passenger car, we attempt to hold the three factors—temperature, humidity, and air motion—within the range that provides the greatest amount of human comfort, regardless of the vagaries of the outside weather. Heat has been used for centuries for increasing comfort in winter, but it is only within the past few years that air cooling and dehumidification are coming into wide use for increasing comfort in summer. The railroads have taken a leading part in this increasing usage, and this year there will be a total of around 10,000 air conditioned passenger cars in regular service. These installations are the result of an extensive study of the factors which provide comfort, the solution of numerous engineering problems, and the development of much new equipment.

When we say that a room or car is air conditioned, the idea conveyed is that a comfortable temperature is maintained winter or summer, regardless of outside weather conditions. This means that sufficient heat must be supplied in winter to counteract all heat loss that may occur. In summer, we must remove from the space all heat in excess of that required to maintain comfort. The cooling system is in reality a heat conveyor, for heat is picked up within the room or car, carried to the outside and dropped. There are a number of factors which determine the amount of heating or cooling required and these will be touched upon briefly.

When we air condition a room, a building, or a railway car, we maintain a temperature that usually differs from the outside temperature, lower in summer, and higher in winter. Because of this temperature difference, we have certain transmission losses through the walls, ceiling, floor and windows of the enclosure. Heat always flows from a point of high temperature to a point of lower temperature, as water flows down hill. The greater the temperature difference, the more rapid the flow of heat and the larger the losses. The losses are dependent upon the materials from which the walls, ceiling and floor are constructed. Certain materials are good heat insulators because the flow of heat through them is relatively slow. If we properly insulate our enclosure, we reduce the losses to a minimum and also reduce the size of heating and cooling equipment required to maintain a given temperature.

Railway cars of metal construction must of necessity use insulation. Tests have shown that about the optimum quantity of insulation is used in Pullman cars, as there are certain unavoidable losses through the metal framing members that limit the value of additional insulation. Double windows are also used for their insulating value, as they reduce the heat losses through the window area about 50 per cent in still air and even more when the wind is blowing.

In summer, the inward flow of heat to our cooled space is increased by solar radiation. At times the heat received from the sun may amount to as much as 4 B.T.U. per square foot per minute. Glass windows offer little resistance to the passage of radiant heat, so that if the sun shines through the windows, this heat is given up to the objects it strikes. It also increases heat losses through the roof and walls as the temperature of these is raised above the outside temperature. We had some tests made at Phoenix, Arizona, which showed that roof sheet temperatures frequently went as high as 170 degrees when the outside temperature was slightly over 100 degrees.

Infiltration of outside air through cracks and crevices has a material effect on the total heat loss. Tests on a variety of buildings show that it may account for as much as 25 per cent of the total heat loss. In Pullman cars it is probably considerably less than this due to the construction used, the double windows and weatherstripping, and to the slight air pressure maintained in air conditioned cars.

In winter, the body heat of the occupants of a room helps to warm the room; in summer this becomes additional heat that must be removed by the cooling system. The body heat per person amounts to 400 B.T.U. per hour. One ton of refrigeration will take care of 12,000 B.T.U. per hour, so you can see that if you have 30 people in a room, their body heat alone will require a full ton of refrigeration to prevent the temperature from rising.

In addition to the foregoing, there is the heating or cooling of the fresh air that is supplied for ventilation. In the earlier cars that were air conditioned, it was believed that 25 to 30 per cent of the total amount of air handled was the limit on the fresh air that could be properly heated during extremely cold weather, or properly cooled on a hot day. This amounted to, roughly, 25,000 cubic feet per hour, which, on the basis of 1,500 cubic feet per occupant per hour, as prescribed by most city ordinances, was more than ample for the number of people ordinarily occupying a Pullman car. During the past two years we have found that because of improvements in the equipment, we have sufficient heating and cooling capacity to take in 90 per cent fresh air, except during a very few extreme days, and

**This is a part of a paper presented at the Engineering Society of Wisconsin 1937 Convention in Madison, March 4-5.*

even then we can use 50 to 60 per cent. Such a supply of fresh air is several times that required for good ventilation, but is very desirable as it makes the cars feel cleaner and fresher and it largely overcomes the odors of tobacco smoke, perfume, cosmetic, et cetera, which, while not harmful, are objectionable to some people.

While cars are cooled by several different systems, the overhead portion is quite similar in all of them. A blower with a capacity of about 100,000 cubic feet of air per hour against ¾ inch static pressure, and driven by a ½ H.P. motor, draws in the desired amount of fresh air and recirculated air through air filters, forces it through the heating or cooling coils and delivers it through the ducts into the car.

The air filters are usually two or more 20 inch by 20 inch sections of the labyrinth type, 4 inches thick. The filtering surface is covered with an adhesive oil which holds the dust. When dirty, these filters can be thoroughly cleaned and re-oiled. Interconnected dampers are provided for varying the percentage of fresh air in three steps of 30, 60 and 90 per cent.

The cooling coil, through the tubes of which the cooling medium circulates, presents a large finned surface through which the air being cooled is forced. The fins, of which there are several hundred square feet, are arranged six to the inch, so the air comes into very intimate contact with them. Drip pans and drains are provided underneath to remove moisture that is condensed out of the air during cooling. The heating coil, which use steam at atmospheric pressure, is of the same type construction but much smaller. This coil heats the fresh air to car temperature and is thermostatically controlled. Additional heat is supplied from heating coils located just above the floor along each side of the car. These are necessary to keep the floor warm and to counteract the effect of cold side walls and windows during very cold weather. Floor heat coils are also thermostatically controlled.

The ducts which deliver the air to the car are usually located on the side deck on the outside of the car roof. They have an inner galvanized iron shell, a heavy layer of cork or hairfelt insulation, and an outer protective sheet steel cover. Inlets are provided into each section and room, with an orifice plate for limiting or adjusting the air flow, and louvered diffusing outlet grilles. Blowing of heated air into a car is easily accomplished, but cold air being heavier and having a tendency to fall must be well diffused to prevent drafts.

In rooms we provide a diffusing panel of Burgess or finely perforated metal the full length of the room for better diffusion. This seems to accomplish the purpose very satisfactorily.

The cooling systems applied to cars, which all accomplish the same results and have the same capacity, are divided into three classifications as follows:

Ice actuated cooling system; mechanical compression system of refrigeration; steam ejector system of refrigeration.

A car using manufactured or natural ice for cooling has well insulated bunkers or ice boxes of about 5,000 pounds capacity, located under the car. Connected to these ice boxes by drain pipes is a sump tank for holding the cold water. This water is drawn from the sump tank through a strainer by a motor driven centrifugal pump of 18 gallons a minute capacity, which forces it through the overhead cooling coil and back to the ice boxes, where it is sprayed over the ice and re-cooled. As the ice melts, a surplus of water results, which is disposed of by passing it through a pre-cooling coil located in the path of the fresh air supply. Here it absorbs heat until its temperature is raised to say 70 degrees, and it is then thrown away.

The car temperature is maintained at the desired point by a cooling thermostat, located in the path of the recirculated air, which starts the pump when cooling is required, and stops or bypasses it when the desired temperature is reached.

A pound of ice at 32 degrees absorbs 142 B.T.U. of heat to convert it into water at the same temperature. This water absorbs one more B.T.U. per degree, or a total of 38 B.T.U. of its temperature is raised to 70 degrees. This gives a total heat absorbing capacity of 180 B.T.U. per pound. During hot weather, a car uses an average of 250 pounds of ice per hour, or a total cooling capacity of 45,000 B.T.U. per hour, or almost 4 tons of refrigeration. For many applications ice is an economical and satisfactory cooling agent.

The usual refrigerant used in the **mechanical compression system is Freon** (dichloro difluoro methane), a non-toxic and non-inflammable liquid which boils at atmospheric pressure at a temperature of 22 degrees below zero. At 40 pounds pressure it boils at +43 degrees. As used on a car, liquid Freon, from the receiver tank under the car, is admitted to the overhead cooling coil or evaporator, through a thermostatically controlled expansion valve, where it is maintained at roughly 40 pounds pressure. The air to be cooled passes over the evaporator which is maintained at 43 degrees by the boiling Freon. The heat picked up from the passing air causes the boiling and converts the Freon into a vapor or gas. This gas, containing the heat picked up, is withdrawn as fast as it is formed by the suction action of the compressor which compresses it to a fairly high pressure and correspondingly high temperature. From the compressor it goes to the condenser where its temperature is reduced as it gives up heat to the large volume of outside air which is blown over the finned condenser surface. At this high pressure and reduced temperature the Freon gas again condenses to a liquid and flows to the receiver tank for another cycle of operation.

The compressors ordinarily used are either two or four cylinder, air cooled machines, with a capacity of five or six tons of refrigeration. The power required averages about 1½ H.P. per ton. To obtain this amount of power on a moving car presents a problem, but three systems are now commonly used.

In one of these, developed by Pullman-Standard Car Manufacturing Company, power is taken from the car axle by a "V" belt drive, and is transmitted by a universal drive shaft through an automatic speed control, to the compressor and condenser fan. The speed control consists of an outer cast steel armature driven from the car axle, an inner electro-magnetic rotor, with six poles and field coils, which is connected to the compressor drive and an automatic governor which controls a variable resistance in the field circuits. When the armature is rotated and the field excited, the latter follows the armature due to magnetic drag, but at slightly slower speed, due to slip. At a car speed of 42 M.P.H., at which the compressor is driven at its rated speed, the governor comes into action, and for increasing car speeds gradually weakens the field, so that the compressor speed is maintained constant. When the car is standing in the yard or station, the compressor can be driven by a 10 H.P., 220 volt, 3-phase motor, which is plugged into an outside source of power.

An auxiliary holdover system has been devised for cars equipped as above to furnish cooling during train stops of an hour and one-half or less. This consists of another evaporator mounted under the car in a tank containing a liquid solution. During periods when the car is down to the desired temperature the compressor is ordinarily stopped, but with this holdover system, the compressor is allowed to run, but the liquid Freon is switched by solenoid valves to the auxiliary evaporator where it freezes part of the liquid solution into ice and sludge ice. When the car stops this cold liquid solution is pumped through an extra cooling coil located overhead. The pump is thermostatically controlled by car temperature.

Another arrangement now being tried by several roads, utilizes an internal combustion engine to furnish the power for driving the compressor and condenser fan. Propane gas, which is carried in steel cylinders, is used as fuel. The car thermostat starts and stops the compressor by controlling the automatic starter on the engine. An automatic clutch between the engine and compressor permits easy starting.

With the third system, usually referred to as electro-mechanical, the compressor is driven by a combination AC-DC motor. Power for the DC part of the motor is obtained from a 1,000 ampere hour storage battery and a 15 KW generator, which is driven from the car axle. While the car is running or during short layovers, this source of power is sufficient, but for longer layovers, the AC part of the motor is usually plugged to outside power lines.

In the mechanical compression system, the condenser plays a very important part. All of the heat picked up in the car, as well as the heat of compression, must be dissipated in this unit in order to reduce the temperature of the Freon gas to the point where it will condense. The condenser is of the finned tube type with the fins offering a very large surface to the air that is blown through them by the condenser fan. This fan, which consumes around ¾ H.P., handles 6,000 or 7,000 cubic feet of air per minute.

The **steam ejector** system uses steam from the locomotive as its principal source of power, and water as its refrigerant. Its operating principle is based upon the fact that water at a reduced pressure will boil at a low temperature. Water open to the atmosphere boils at 212 degrees F.; in an enclosed vessel, in which the pressure has been reduced to a vacuum of 28 inches, it boils at 100 degrees; if the pressure is further reduced to a vacuum of 29.55 inches, it boils at 50 degrees.

In this system the evaporator acts as the enclosed vessel and the steam ejector with its air and water cooled condenser produces the vacuum. The water cooled in the evaporator is circulated through the cooling coil in the air conditioner and then is brought back to the evaporator for re-cooling. Two motor driven pumps are required, one to circulate the cold water and the other to spray water over the condenser; also two motor driven blower fans, one to handle the conditioned air in the car and the other to blow a large volume of air over the condenser. The electrical load is around 4 K.W. The cooling thermostat shuts off the refrigerating units when the car temperature has reached the desired point and starts it up again when the car temperature has risen a predetermined amount.

In the operation of air conditioned cars, a great deal has been learned. Each year it has been possible to make improvements in the equipment, in air distribution and in the actual handling of the control by the train crews. One problem which came up about two years ago was the ventilation of lower berths. It was found that although the aisle temperature of the car was maintained at 71 degrees at night, the berths in warm weather averaged a few degrees higher. This problem seems to have been solved by the application of a lower berth ventilation system which permits the blowing of a variable quantity of air into the berth. This is under the control of the berth occupant, and he can use it or not as the need arises. Tests indicate that the berths can now be kept perfectly comfortable in the hottest weather.

There have been some cooling failures, as is to be expected with apparatus such as this, but their number is relatively small. Last year they amounted to around four-tenths of one per cent. The cars are providing comfort for the great majority of people who use them, in fact, much greater comfort and cleanliness than has been available in the past. The traveling public seems to have enthusiastically accepted air conditioning of railway passenger cars as a very decided improvement.

WITH THE SOCIETIES

PI TAU SIGMA

February 24, Pi Tau Sigma met in their room at the M. E. building. The first business of the evening was the election of new officers for the next semester. They were: president, Donald De Noyer; vice president, Roger Stanley; secretary, Willard Hansen; treasurer, Stanley Kranc; corresponding secretary, John Meyers. After the new officers were chosen, the meeting discussed the junior mechanical engineers to be chosen this spring. Initiation ceremonies and the banquet date have been set for March 31. The pledges' names will be given out when all acceptances have been received.

A.I.E.E.

The annual joint meeting of the Student Branch of the A.I.E.E. with the Madison Section was held Thursday, February 18. A dinner was given in the Old Madison room in the Union at 6:15 p. m. in honor of the speaker, Mr. D. M. Simmons, chief engineer of the General Cable Corporation, and guests including Mr. Pettee and Mr. Shull, engineers of the same corporation from Chicago.

At 7:45 p. m. the meeting was transferred to the Engineering building auditorium, where Mr. Simmons presented a very interesting illustrated talk on Boulder Dam. Besides the power transmission facilities at the dam, the talk took in the entire project, including water, irrigation, and flood control.

The general public was invited to attend the meeting.

A.S.C.E.

Ray Voelker, vice president of the student branch of the American Society of Civil Engineers, became the chapter's candidate for St. Pat at an election held during the regular meeting on Friday evening, February 26, in the Memorial Union. Voelker, who promised a lively campaign, immediately chose a committee to assist him with arrangements for A.S.C.E.'s part in the St. Pat's Day parade.

A proposal that the chapter sponsor a one-day inspection trip sometime this spring was presented. The trip would take in points of interest in the fields of highway, hydraulic, and structural engineering in the Madison, Prairie du Sac, and Baraboo areas, and would be open to all civil engineering students.

Entertainment during the program included two sound motion pictures, one being entitled "South Sea Adventures of Zane Grey," and the other dealing with the work being done by the CCC camps in California. After adjournment, refreshments of beer and pretzels were served.

A.S.M.E.

The A.S.M.E. held their regular meeting on March 4 in the auditorium of the M.E. building. E. E. Baur was elected sophomore Polygon representative and Jack Barlow was chosen candidate for St. Pat. The guest speaker was Mr. Campbell of the Wisconsin Power and Light Company. He discussed the Edgewater Power Plant at Sheboygan, laying particular stress on the operating difficulties. Incidently, his lecture was a great help to the boys taking power plant engineering.

At the completion of the evening's program, the meeting adjourned without the usual refreshments.

A N N O U N C I N G

A Picture Contest

for the best pictures taken of the

St. Pat's Parade

RULES

1. Pictures are to be placed in an envelope with the name, address, and telephone number of the taker thereon, and deposited in the slot in the door of room 220, Engineering Building, by noon, WEDNESDAY, APRIL 7.
2. The *Wisconsin Engineer* shall have the right to use any and all pictures submitted.
3. Competition is open to everybody except members of the *Engineer* staff and Polygon board members.
4. Prizes will be awarded as follows:

   1st—One $6.75 Leicascope Exposure Meter
   2nd—One 5x7 Portrait
   3rd—One 8x10 Enlargement from any negative

   These will be contributed by the Photoart House, 413 State St.
5. Judges shall be Mr. L. F. Van Hagan, Mr. K. F. Wendt, and Mr. Wm. J. Meuer.

Some Problems of Rural Electrification

(Continued from page 108)

with rural lines know it. But what about the farmers who own these REA projects?

They will have to learn it if they do not already know it. And how is that job going to be done? The TVA is doing a splendid job of aggressive merchandising and education. The Rural Electrification Administration in Washington has a utilization section which is now studying ways and means of load building. It is going to take a well-integrated educational program to impress local co-operatives with the importance of intelligent selection and use of appliances, with the necessity of using money making devices and increasing their electric consumption.

The first educational task facing rural electric cooperatives is the urgent necessity of explaining and stressing the importance of adequate wiring, for otherwise rural customers will not have the basic framework to permit the extensive use of electricity. Group loan arrangements for wiring and appliances can now be made through REA and the Electric Home and Farm Authority respectively.

While no funds are available for an educational program in the state at the present time, we have had the liberal cooperation of the agricultural extension service of the university which has been conducting a series of educational wiring meetings in the areas of our most advanced projects. They have already conducted more than 40 meetings, with an average attendance of 80 at a meeting.

Just lights is not rural electrification. Rural electric co-operatives must realize the necessity of bringing the farm user's consumption up to the point where an actual income increase due to the use of electric equipment is effected. Then rural electrification will help to solve the primary social problem of the farmer . . . low income.

It isn't going to be an easy job. We have already gone through many guinea pig stages, but because rural electrification on a large scale is a new venture, there are a good many more guinea pig stages through which we will have to go. We are not yet out of the woods. It will take loyalty and courage and hard work, but I am confident that the members of Wisconsin REA cooperatives will contribute plenty of all three.

"STATIC"

By ENGIN EARS

Spring is in the air, or is it? Eric Miller says so, but one generally gets you five when he's right. Anyway, the ground hog has taken a gander at his shadow and scrammed; the birds, the bees, the buds, and all the little woodland creatures are out (Ed: Cut out that Octy stuff).

Every year the engineers, a bit superheated by the spirit of Auld St. Pat, flex their muscles in simple harmonic motion, expand their chests adiabatically, and go to work on a certain undesirable element in the student population, namely the shysters. The much discussed housing program will soon be forgotten in the grim task of fumigating the existing structures of the vermin, rats, lawyers, and other small pests who breed therein under the woodwork and beneath damp stones through the long winter months. The most effective reagent (developed long ago by our brilliant Chem. Engineers) is hydrogen sulphide, and if you don't know what that is now . . . brother, you'll soon find out!

This coming out party affords practical application of the materials testing course, shillelaghs being tested under actual operating conditions, so to speak. The kinetic theory of gases also gets a real workout, as does the old question of which came first: the chicken or the egg (veterans of past parades claim it's a dead heat). Considering the excellent practical experience it affords the students, and the worthy motives behind it, our parade generally receives altogether too lukewarm a support from the State Street merchants. However, it is rumored that this year's triumphant St. Pat's Parade will be ably sponsored by such loyal firms as Badger Cleaners, Pantorium, the Dane County Hatcheries, and even the Madison Window Cleaning Service, Inc.

Shysters, this is your warning to bow your evil noggins when St. Pat and the Blarney Stone go by . . . or you'll be trading those canes for crutches!

» » « «

According to Webster, taut means tight.

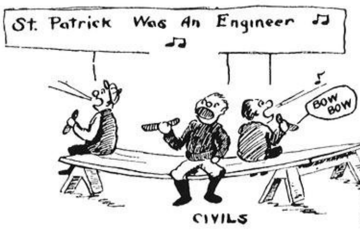
There are more people taut in this school than generally supposed.—**Kansas State Engineer**

That old skeleton-in-the-closet, our Voice of Experience, turns up to pour a few timely bits of history into our defenseless frosh in:

ERIN GO BRAGH
or
Are Shysters People?

Day by day, engineering science drives ahead, pushing back the frontiers of ignorance (final exams mean nothing to us). You who are freshmen walk in awe about our hallowed halls, where portraits of Watt, Faraday, Sally Rand, and Steinmetz (Ed. note: I'll verify that list) beam upon one. But where is our portrait of Pat, the original engineer, the founding father and patron saint? The legislature, it is believed, will investigate this next fall.

St. Pat was truly the pioneer of our field. He first won acclaim with his invention of the worm drive gear, with an enlarged unit of which he drove the snakes out of Ireland, case books, canes, and all. Thus began sanitary engineering. It was he also who specified good intentions for paving the road to Hell, and you've gotta admit that THAT surfacing job has stood up well under the heavy traffic it bears. It was he, too, who created that greatest of all engineering tools, the can-opener, for the express purpose of getting the beer out of cans. A minor triumph was his left handed monkey wrench. They say he was so fast with the slide rule that his slider had to be water-jacketed to keep it cool as he worked. He also invented Calculus, but we mustn't hold that against him, E.E. not being invented for many years after.



Now the season has arrived wherein he pays his annual visit to Madison to escort the precious Blarney Stone on its ceremonial rounds, a symbol that his spirit reigns still, come mud or eggs. Thereafter he vanishes, and with him the Blarney Stone, with its strange inscriptions, its seal of St. Pat was a great pi, his mark, and its motto, "Erin Go Bragh" which (by application of Gauss's Theorem and the T-phi diagram) can be easily translated to read "ST. PATRICK WAS AN ENGINEER"!

» » « «

Doctor: You must avoid all forms of excitement.

Steketee: But, doctor, can't I even look at them on the street?

» » « «

A slide rule, says the Iowa Engineer, is like a woman. It is slippery and no one ever fully learns to manage one. It has a variety of figures which are more or less true, but its beauty is only skin deep. Men are crazy till they get one, and after they get it they wish they had saved their money.

» » « «

Executive ability is the art of getting all the credit for all the hard work that someone else did.

More Material for the Hat-Stretching Dept.

No longer can the old die-hards claim the engineers to be a surly, unshaven, clumsy, slipstick-bedecked race, for verily, every social event of the current season was "engineered" by an engineer. Gordy Fuller, Homecoming Chairman is an ENGINEER; Bill Pryor, Prom King, is an ENGINEER; Jack Heuser, Soph Shuffle Rex, is an ENGINEER; Allen Jorgenson, Military Ball Monarch, is an ENGINEER . . . gee, but this gets monotonous. In fact, the only social event our boys did not dominate was the Law Brawl—as could hardly be expected.

» » « «

The physicist is said to be a man who knows a great deal about very little and who goes along knowing more and more about less and less until finally he knows practically everything about nothing; whereas the lawyer, on the other hand, is a man who knows very little about a great deal, and keeps on knowing less and less about more and more until finally he knows practically nothing about everything.—**North Dakota Engineer.**

» » « «

Prof. Wahlin stood on the corner. He stood and stood and stood. The rain poured straight down (this is called normal precipitation, fellers) and he shivered. Lo, out of the West came young Lochinvar Hafstrom, and this time there was a Ford—he in it. Grasping opportunity by the forelock, he trompled on the brake, produced a negative acceleration, finally reduced the vehicle's kinetic energy to zero, loaded on his precious passenger, and delivered him safely home. Comes the next comp. section, with Mr. Hafstrom awaiting approbation. So what? Prof. Wahlin merely makes derogatory remarks about Fords in general and one contrivance in particular. What price appreciation!

» » « «

The following telegram was received by Prof. G. F. Tracy on Monday, February 22 (Washington's Birthday), from two members of his class in E.E. 9 who had taken advantage of the holiday to migrate to Wisconsin Rapids:

1937 FEB 21 PM 11 43
AUU 161 45 NL=WI WISCONSIN RAPIDS WIS 21
GORDON TRACY=
2616 VAN HISE AVE
THE SNOW IS SNOWING THE WIND IS
BLOWING THE LINE RESISTANCE IS VERY
HIGH THE CAR IS SMALL THE DRIFTS ARE TALL
AND OF HIGH VOLTAGE WE ARE SHY SINCE
ALL OF THIS WILL CUT OUR RATE WE MAY
NOT SEE YOU TUESDAY AT EIGHT=
SCHWANBERG AND GETZIN.

Good fortune favored these gentlemen, for they mastered the hazards of high voltages and high drifts and showed up promptly at eight, Tuesday morning.

» » « «

And then there was the freshman engineer who thought that a neckerchief was the leader of a sorority house.

» » « «

Well, if you have a college diploma and a nickel, you can always get a cup of coffee.

EDITORIALS

FINANCIAL SKY HOOKS FAIL IN ALBERTA

Eighteen months ago, the Province of Alberta, Canada, elected William Aberhart as premier for four years on a social security platform. Every adult in the province was to receive from the government $25 a month. A press story on March 1 gives us the outcome of the scheme: Premier Aberhart is quoted as saying. "We have been unable to introduce social credit as we had hoped," and he announces his readiness to quit his post.

During the eighteen months, valiant efforts were made by the premier to carry out his promises. Funds were not available to pay the monthly dole, so phoney money was issued that had to be stamped by the holder at stated intervals, with stamps purchased from the government. Efforts to make such money circulate were not successful.

Ordinarily, the people must support their government. There have been exceptions in the case of nations engaged in conquest and therefore able to distribute spoils or tribute among the people, but government support is not the general rule. To think otherwise is to reveal a naive belief in financial "sky hooks." An engineer knows that he cannot support a structure on sky hooks; it must rest on a firm foundation. Economic visionaries, however, seem to think that an analogous feat can be accomplished if only the sky hook be complicated enough to make it incomprehensible.

"There is just one condition on which men can secure employment and living, nourishing, profitable wages, for whatever they contribute to the enterprise, be it labor or capital, and that condition is that someone make a profit by it. That is the sound basis for the distribution of wealth and the only one. It can not be done by law, it can not be done by public ownership, it can not be done by socialism. When you deny the right to profit you deny the right of a reward to thrift and industry."

—Calvin Coolidge

THE FLYING ENGINEER

Ten Wisconsin men either hold commissions in the U. S. Naval Reserve as fliers or are taking training. The seniors will be interviewed again this year by a representative of the Reserve for the purpose of selecting a new crop of cadets. The physical requirements are severe and the training is rigid. The men who finally qualify for commissions must have a natural aptitude as pilots.

The purpose of the government is to provide a supply of high-grade pilots in case they are needed. At the end of the course, a man must decide whether to re-enter the field of engineering or stick to flying. If he intends to continue in engineering, he will have delayed his start by three years. This is not a serious matter in the case of a young man, but is a feature that must be considered. If he decides to stick to flying, he will be making a connection with air transportation in its infancy. The great expansion of air transportation is ahead and not behind.

The romantic urge is strong in the normal young man today as it was when great portions of the world were undiscovered. Not every young man can satisfy that urge in the laboratory prying in the new worlds that science is revealing; many of them demand more robust adventure. Flying offers an opportunity to find such adventure.

OPPORTUNITIES IN POWER GENERATION

"But there's nothing left in modern plants for further development," an engineering student said regrettedly when visiting a new power station. He seemed convinced that his services and those of his fellow students would probably not be required in power plants; that the fairly rapid development to date had precluded the possibility of further improvements. Though his unconsciously proffered compliment of the station was keenly appreciated, it required positive refutation.

Starting right now, greatly better and more engineering talent is needed for further power plant development. Only the easily-attained, relatively crude improvements have been made to date. Simple principles and practices have been exploited, with resulting great gains, but multitudes of improvements, not as easily perfected, are still well worth while. Obviously, their attainment will require application of increasingly better engineering; engineering of greatly higher type.

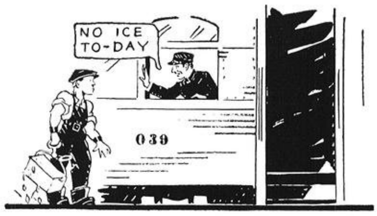
When 1,000 degree F. superheat and reheat steam temperatures are used in company with 1,800 pound steam pressure, boilers will become auxiliaries of superheaters. The problems of reversing places of this major equipment will not be simple.

Heat transfer principles and information have scarcely made their debut into the power plant. Boilers, condensers, and other heat exchangers, developed in the past principally by slow rule-of-thumb methods, can be made to do new tricks by the engineer who really knows heat transfer. The excellence of equipment proved best by long-time practice is realized, but the impossibility of further large developments is not admitted. Heat transfer is an important power plant subject.

Cost reductions, and accompanying improved service, are not precluded developments. Could all present unnecessarily heavy weights of structures or equipment be eliminated by more intelligent design, an appreciable cost saving could be made. New principles of design offer still greater possibilities. More advancement might be made by reducing fixed charges than by lowering operating costs.

Power plants will require application of more and better engineering. They are far from ultimate development. "Bigger and better" engineers are needed.

G-E *Campus News*



ICE WATER

New electric drinking-water coolers introduced by General Electric have replaced the antiquated ice-cooled type on several prominent Midwestern railroads. This is another step in the modernization program being carried on by railroads to increase passenger traffic.

The new coolers are designed to overcome many disadvantages of the ice-cooled units. With foot operation of the self-contained units, only one hand need be used to get a drink. Cleanliness is promoted because of the absence of ice-filling operations, and the expense for maintenance and service is reduced to a minimum.

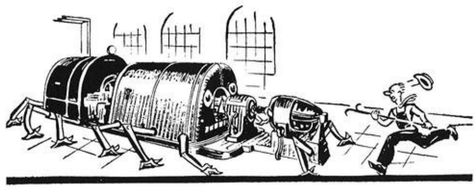
The water is automatically maintained at a healthful and refreshing temperature through thermostatic control. Coolers are designed either as self-contained units or as separate cooling and refrigerant condensing units for remote installations in the car.

AS VACUUM TUBES GREW UP

As the vacuum tubes grew, they found their style cramped because metal could be sealed to glass only in thin strips. Research took up the problem, and it is now possible to fabricate glass and metal together, in any size or shape, very much as two metals are fabricated.

In a successful glass-to-metal seal, the temperature coefficients of expansion of the glass and the metal must agree exactly over a wide range of temperature. Painstaking investigation—much of it in the General Electric Research Laboratory, at Schenectady—developed new alloys and new glasses, which could be used for this application.

The first application of this new knowledge has been in metal radio tubes, now standard in almost all radio receivers. Power thyratrons, switches, capacitor bushings—all these follow along the new trail. We cannot predict how far this new technique will go, but the possibilities are numerous and inviting.



TURBINE STEEL CREEPS

If the wrong kind of steels were used in turbine construction, the machine would not go creeping across the floor with the operator in hot pursuit, but the results might be even more disastrous.

Part of the increase in efficiency that has come about in the power-generating field in the last few years has been due to increased steam temperatures and pressures. As a result, the modern turbine shell runs, almost literally, red hot. This shell must withstand pressures such as exist half a mile down in the ocean and must keep a 20-ton rotor spinning perfectly in line. Heat softens metal, just as it softens candy, and permits it to stretch. This stretch, however, must be kept to the merest creep—about one part in 1000, if the changes are uniform.

In the Schenectady Works turbine shop, automatic electric furnaces hold samples of turbine steel at the temperature which will occur in the turbine. Gauges, which indicate changes of one part in a million, measure the creep as the pieces are exposed to heat for years at a time. From these tests, the best steel is selected.

It has been largely due to this research carried on by General Electric that the temperature and pressure of steam used in power generation have been raised to unexpected highs in the last few years.

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GENERAL ELECTRIC