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[T]he Wisconsin engineer

November, 1948

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Training for New Engineers

Power Alcohol

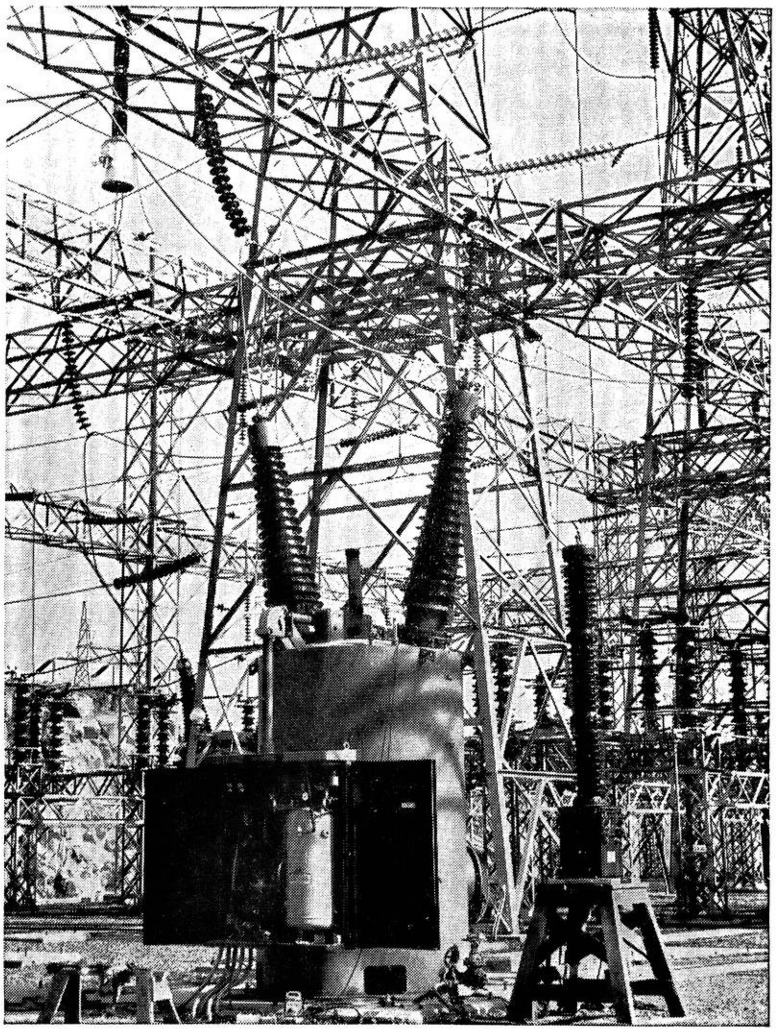
Artificial Beauties

Newest Lab

Jumo-004

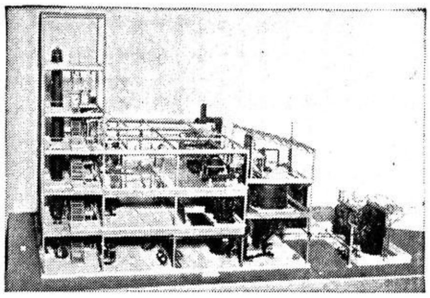
Scholarships

15¢



THE DU PONT DIGEST

FOR STUDENTS OF SCIENCE AND ENGINEERING



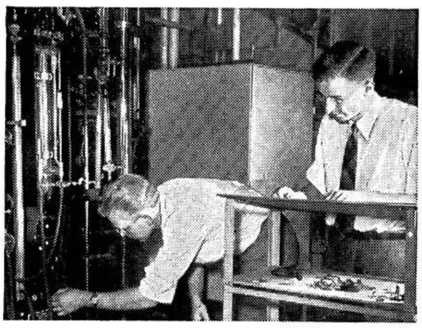
Scale model *of a part of the Du Pont adiponitrile plant at Niagara Falls. Here furfural, an agricultural by-product, is converted into a chemical intermediate for making nylon.*

yarn from corncobs!

A DU PONT PROCESS CONVERTS FURFURAL INTO A CHEMICAL FOR MAKING NYLON

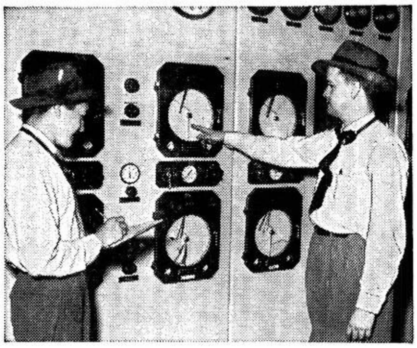
One of the fascinating things about nylon is the unlikely sounding raw materials that go into it. Popularly, nylon is said to be made from coal, air and water. This is because originally, in developing its chemical intermediates, chemists used benzene (from coal), ammonia (from air and water), and oxygen (from air).

But Du Pont is always looking for new ways of doing things. After the discovery of nylon in 1934, research men immediately began looking for alternative ways of making the two main intermediates—adipic acid and hexamethylenediamine. In 1935, when nylon was still in the laboratory stage and three years before its commercial debut, they started work on the possibility of using furfural in the process.



A. G. Sveinbjornsson, *Ph.D., Organic Chemistry, University of Kansas, 1948, and H. B. Copelin, M. S., Organic Chemistry, Cornell, 1941, studying new furfural derivatives.*

Furfural has been used in the chemical industry for 25 years, but it is little known to the layman. A tan-colored liquid with a faint bitter-almond odor, it is made from a wide variety of agricultural by-products. Among these are corncobs and hulls of cottonseed, oats, rice—all available in practically unlimited quantities from America's farms.



C. R. Dewey, *B. S. Chem., Niagara University, 1941, and J. M. Estes, B.S. Ch.E., University of Missouri, 1937, engaged in production of adiponitrile at the Du Pont Electrochemicals plant in Niagara Falls, New York.*

14 Years of Research and Development

It seems a far cry from corncobs to nylon, and it was. The development from the first small-scale laboratory experiments to the present full-scale plant cost 14 years of time and about five million dollars. But it enabled chemists to produce large quantities of adiponitrile, the compound from which hexamethylenediamine is made, by an economical process which uses natural materials that are in continuous supply.

In the new process, furfural is converted by a series of steps to 1,4-dichlorobutane. The next step explains in part why Du Pont undertook the project in the first place. As producers of cyanides, they had sodium cyanide available for converting the 1,4-dichlorobutane into adiponitrile.

The final product, hexamethylenediamine, is then reacted with adipic acid to make nylon "salt." Still more processing and the salt becomes yarn, and the nylon flake used by the plastics industry.

Opportunities at Du Pont in many scientific fields

This is an excellent example of the interesting work in industrial organic chemistry carried on at Du Pont. It required the technical knowledge and skill of highly trained research and development men, including organic and physical chemists; chemical, mechanical, civil and electrical engineers, and others.

Only a large company with ample resources in men and money could afford to engage in research of such magnitude. To the young college graduate, Du Pont offers the broadest of opportunities in many scientific fields, along with the advantages of working directly with a small group of associates.

Keynote of Du Pont personnel policy is promotion from within on a competitive merit basis. A conscientious effort is made not only to choose college-trained people of promise, but to develop each individual as rapidly as possible.

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WISCONSIN ENGINEER

Founded 1896

Volume 54 NOVEMBER, 1949 *Number 2*

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Oscillogram of pressure and temperature variations as a function of piston position in a diesel engine. The curves are original data from the combustion research in T-25, University of Wisconsin.

(Photo courtesy P. S. Myers)

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THE WISCONSIN ENGINEER

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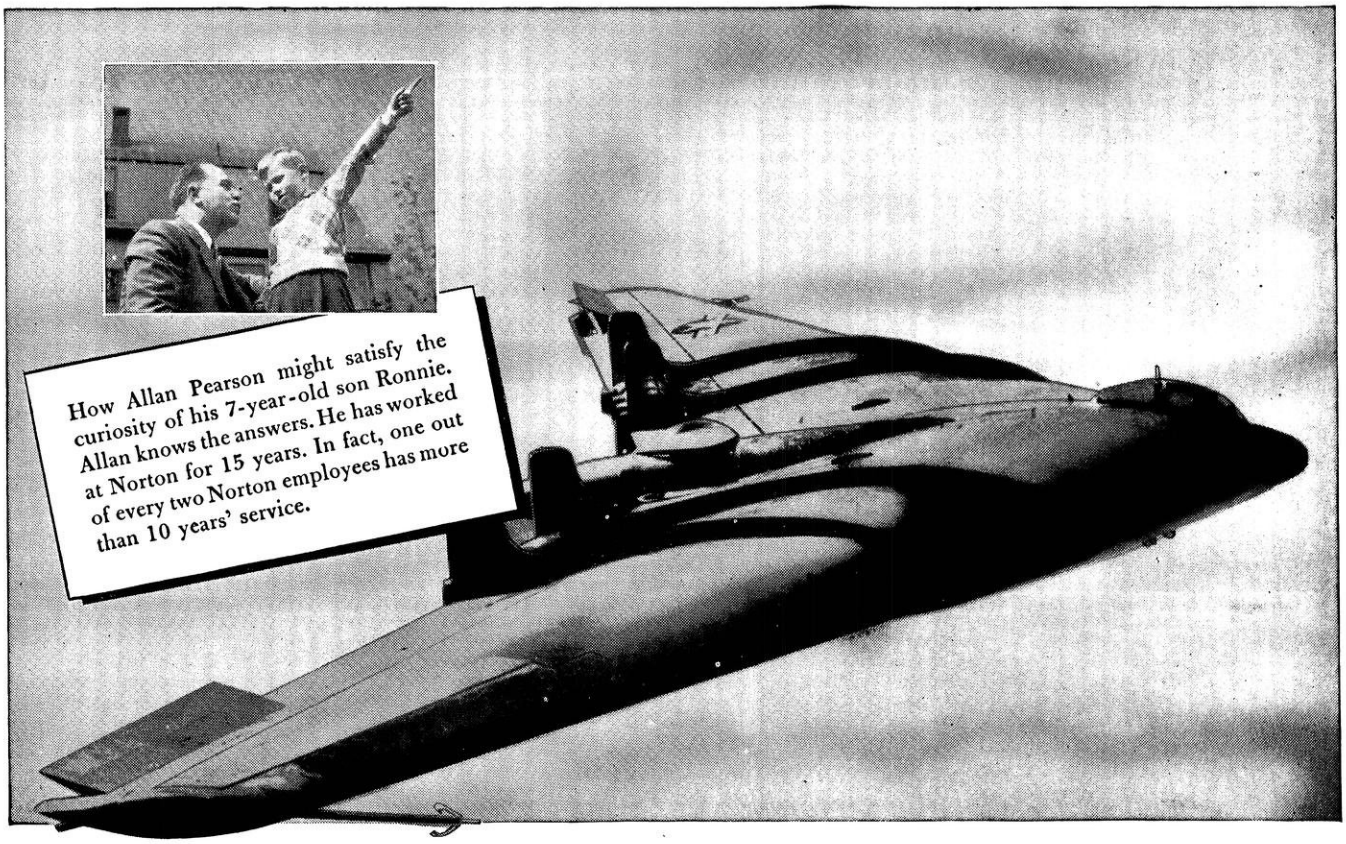

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Standing, left to right:
Don Miller, James Stankey, Fred Kohli, Bruce Roberts, Dick Kolf, John Helm, Keith Jensen, Bob Dickenson, Jack McCoy, Carl Dralle.

Seated. left to right:
Bill Bryan, Prof. K. G. Shiels, Gil Kempka, Robert Wilson.

polygon board's presidents banquet

(Foton Photo)

progress: T-25

by john f. mcCoy, e'50

(*Photos by Mitchell*)

The name T-25 has become a synonym for mechanical engineering research on the Wisconsin campus. One of the many temporary buildings which appeared on the U. W. landscape soon after the war, T-25 houses the growing collection of engines and instruments which is the basis for four major research projects today.

A program for Diesel combustion studies was initiated in the early 1930's by Professors Grover C. Wilson and Reed A. Rose. Intensive studies were discontinued, however, when Prof. Wilson left for employment in industry and Prof. Rose left to serve in the U. S. Navy. Mr. Wilson is now coordinator for Ethyl Research Laboratories, and Prof. Rose has since returned to the University.

While the early efforts of the department were confined to Diesel problems, The Wisconsin Alumni Research Foundation in 1944 made a five year grant to permit broadening the field of research to include all types of internal combustion engines. Directing disposition of the grant were Professors Kenneth M. Watson of the Chemical Engineering Dept., and Leroy A. Wilson of the Mechanical Engineering Dept., with Mr. Otto A. Uyehara and Mr. Phillip S. Myers as co-workers.

The spring of 1948 saw the physical plant moved from the M. E. Building to its present location in T-25, where excellent facilities and adequate floor space have contributed materially to progress.

To the layman, research invariably connotes specialization; paradoxically, the backgrounds of the present co-directors include study and experience in almost all of the engineering sciences. Dr. Uyehara took his degrees in Chemical Engineering, but since his association with the M. E. Department has done extensive work in electronics as well as in the mechanical engineering field.

Although both directors concur in the opinion that data gathered by electronic means is, over a period of time, generally less reproducible than that delivered by mechanical devices, many of their instrument designs are, of necessity, based on electrical and electronic engineering principles.

In recognition of his work in the internal combustion engine research program, Dr. Myers was recently presented with the 1949 Gold Medal Award of Pi Tau Sigma, the national mechanical engineering honorary fraternity. The medal is awarded annually to the Pi Tau Sigma member of five to ten years graduation who has made the most outstanding achievements in engineering. Since the achievements on which the award was based were the result of the joint efforts of Professors Myers and Uyehara, it is the consensus of local opinion that Prof. Uyehara shares unofficially in the award.

Overall Interest

Broadly stated, today's research in T-25 is directed toward finding the correlation between combustion performance of fuels and their readily measured physical characteristics.

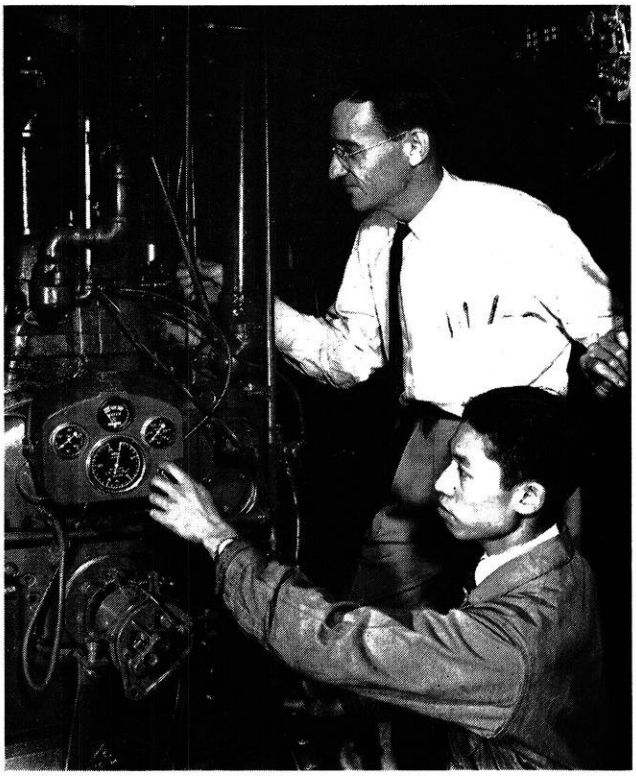
Four Specific Projects

Graduate students are doing thesis work on four basic combustion projects:

1. DIESEL COMBUSTION has been assigned to Prof. John H. Thomas of the University of Oklahoma, here on a year's leave of absence, and to Mr. Chow Weichien of Kwangton, China.
2. OTTO COMBUSTION research is being done by Dr. Mohamed El Wakil, Alexandria, Egypt, and Mr. Gordon H. Millar, Detroit.
3. STEADY FLOW COMBUSTION research is the responsibility of Mr. Vet V. Holmes, Wisconsin Rapids, and Mr. Alden J. Pahnke, Green Bay.
4. The COMBUSTION BOMB project has been assigned to Mr. Bansun Chang of Kiangsu, China.

Instrumentation Projects

The development of an electro-mechanical MEAN EFFECTIVE PRESSURE INDICATOR is the special in-



DIESEL COMBUSTION
J. H. Thomas, C. Weichien

strumentation project of Mr. James D. Fleming of Saint Jo, Texas.

Mr. Thomas R. Schmidt, Wauwatosa, is doing development work on instrumentation for an experimental determination of the RATE OF HEAT TRANSFER from combustion chamber gases to cylinder walls.

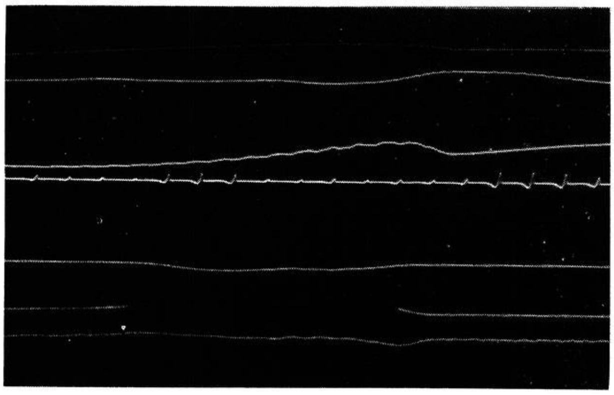
Research Assistants

Undergraduate assistants working on these and other special projects are: Harold R. Ahrens, Princeton; Edward C. Doehler, Wauwatosa; William O. Fritz, Milwaukee; Milton G. Mardoin, Kenosha; John F. McCoy, Portage; John J. Misey, Milwaukee; Richard J. Priem, Mayville.

DIESEL COMBUSTION

A single cylinder General Motors 1-71 Diesel engine is fitted with instrumentation which permits study of combustion of different fuels under controlled operating conditions. Instantaneous and continuous data from eight sources are recorded photographically from vertical electron beam traces on four dual-beam cathode ray tubes.

A drum type, selsyn driven camera rotates a 30" x 2½" film strip at exact engine speed thus supplementing a cam-actuated horizontal beam sweep. The drum camera permits expansion of the horizontal (time) axis to the length of the film strip rather than the diameter of the C. R. tube. The cam actuated beam sweep permits visual observation of the phenomena as a function of piston displacement, and may also be used for taking data by direct scaling.



DIESEL TRACES

In addition to timing or crank position markers (4), each film strip, covering one engine revolution, records the following plots: pressure-time (1), injection-time (2), pressure rate (dp/dt)-time (3), apparent temperature-time (5), true temperature-time (6), true temperature rate (dT/dt)-time (7); additional variables of current interest may be shown on trace #8.

Timing or crank position markers are produced at two degree intervals by a photo tube system actuated by light-source interruption slits cut radially in the periphery of a shaft-mounted disc.

Electro-mechanical strain gauge instruments are used to measure instantaneous pressure and to indicate injection time.

A unique electro-optical pyrometer supplies instantaneous and continuous true temperature data. Inserted directly in the engine head, a self-cleaning quartz rod "window" allows focusing the optical system of the pyrometer on the combustion chamber. After prismatic dispersion, combustion radiation is focused on two photo tubes in such a manner that the electrical ratio of radiation intensity at two different wavelengths is obtained, amplified, and transmitted to the vertical deflection plates of a C. R. tube.

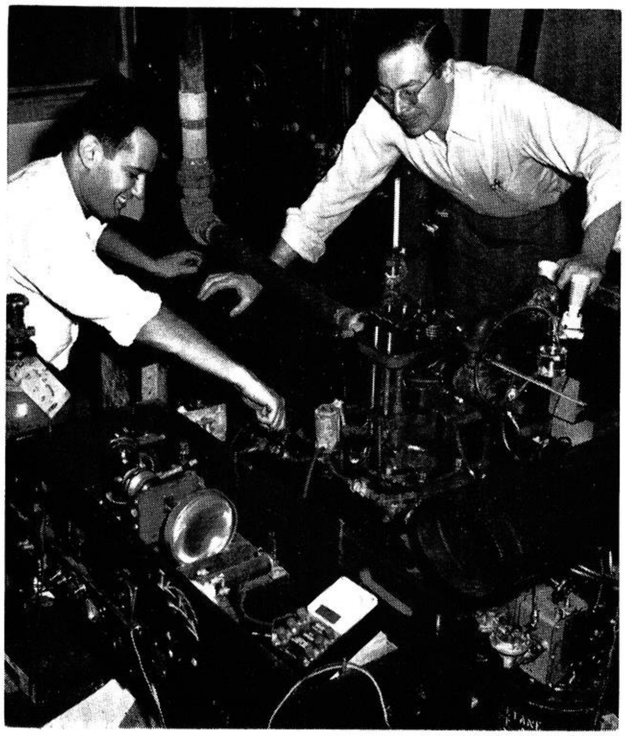
The calibration technique employs an extension of the radiation theory outlined by Hottel and Broughton for the steady state. This calibration permits true temperature data to be scaled from the filmed ratio trace.[1]

At present the photo tube outputs (i.e., the apparent temperatures) are used to modulate two 10 megacycle crystal controlled oscillators. Gain in one channel is controlled by a fast A.V.C. actuated by the detected outputs of both while the gain of the second channel is held constant. The A.V.C. voltage required to maintain equal outputs is thus a measure of the ratio of the two apparent temperatures.

Although reproducible results have been obtained over a period of time using this system, it is here, more than at any other point in the instrumentation, that the greatest advances in precision and simplification may be possible; accordingly, two new ratio circuits are now in the process of development.

A circuit which involves the use of a new two-anode photo tube has been designed under the direction of Prof. Vincent C. Rideout of the Electrical Engineering Dept. by Mr. J. H. Crow. Mr. Crow is now teaching and doing doctorate work at Washington University. Mr. A. S. Alexander has been assigned to continue development.

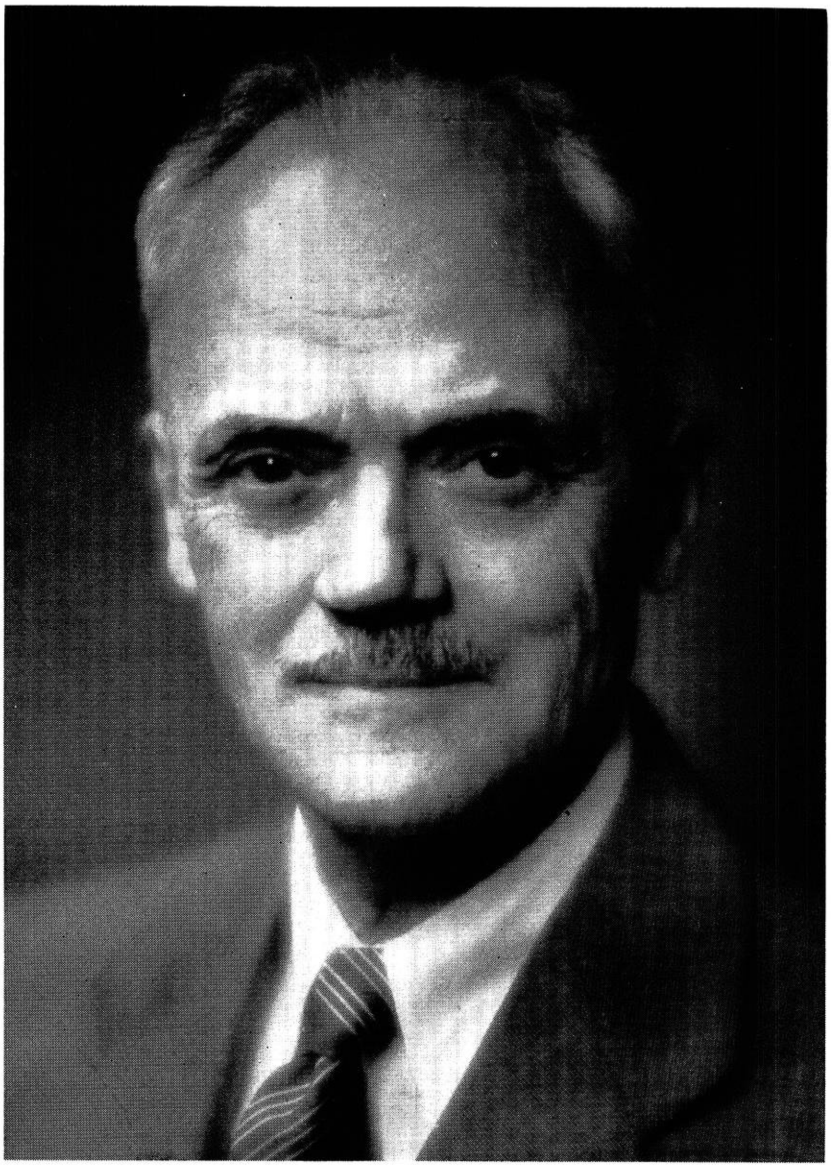
(*please turn to page* 24)



OTTO COMBUSTION
M. El Wakil, G. H. Millar

Editor's Note: This is the second in a series of four biographical sketches concerning the four engineering professors that retired from active teaching last spring.

Emeritus Professor Leslie F. Van Hagen



Professor Van Hagen, who retired at the end of the fall semester last year, was Chairman of the Civil Engineering Department.

Mr. Van Hagen was born in Chicago, Illinois, September 13, 1878. He graduated from the University of Wisconsin in 1904 with a BS in Civil Engineering and a master's degree in 1919.

From 1905 to 1911 Professor Van Hagen was an engineer with the National Railway Lines of Mexico. He was a bridge engineer for the system when the Revolution broke out in 1910. He brought his family back to the States in the spring of 1911, and then returned to Mexico to try to rebuild bridges faster than the revolutionaries could burn them.

He left the country just before the downfall of Diaz.

Professor Van Hagen was appointed to the staff of the University in May, 1911. Also he was appointed to the staff of the State Railroad Commission. He was in charge of the valuation of roadway and track of the electric railway properties in and about Milwaukee. Professor Van Hagen also prepared some of the commission's orders, among them, the order for the elevation of the railway tracks on the South Side of Milwaukee.

During the summer of 1918, he was one of the group of faculty

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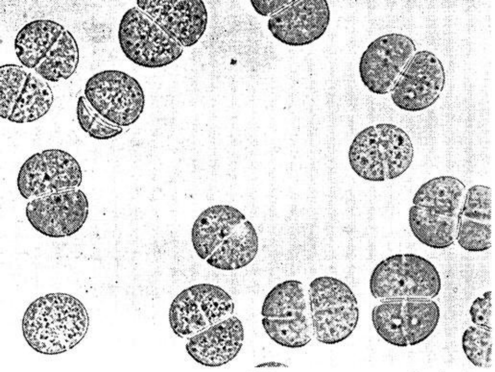


(Photo courtesy Gerloff)

those pesky ALGAE

by charles e. manske, ce'50

Anyone who swims in Lake Mendota is well aware of the green "goo" that clutters up the water, especially during the spring and summer. This gunk consists of colonies, or blooms, of algae, which are microscopic plants living in the water. In addition to being an unsightly nuisance to recreation, this accumulation of masses of dead algae results in putrefaction and the emission of strong offensive odors.

This condition has become increasingly annoying as the quantity of algal growth in the Madison lakes increases from year to year. The problem is even more severe in the three lakes downstream from Lake Mendota, where the quantity of algae is even greater.

However, the algal problem is by no means a local phenomenon. Trouble from the growth of algae, especially in shallow lakes and reservoirs is common throughout the country. Nor is the condition merely a nuisance! Poisonings of livestock have been known to result from toxic materials produced by algae in water to which the livestock had access.

It has never been determined whether danger to public health exists from algal products in water. But odors and tastes in public water supplies are produced by algae, often to the extent of rendering the water unfit for human consumption unless expensive methods of treatment are employed.

What Stinks?

Th particular algae causing the trouble in the Madison lakes are those of the blue-green class, technically known as Cyanophyceae, or more recently, Myxophyceae. Their growth, along with that of other organisms, depends largely upon soluble phosphorus and inorganic nitrogen in the water, although other nutrient materials are also necessary. The algal fertilizers occurring in Lake Mendota originate largely from the surrounding well-fertilized agricultural lands. Drainage of the Lake Mendota watershed carries these nutrient materials into the lake both directly and by means of several tributary streams. The decomposition of bottom deposits of the bodies of plants and animals which previously lived in the lake also releases nutrients to the water. Therefore the fertility of the lake is gradually increasing, which indicates that the conditions are likely to become more severe in the future unless some method of removing nutrient materials is employed.

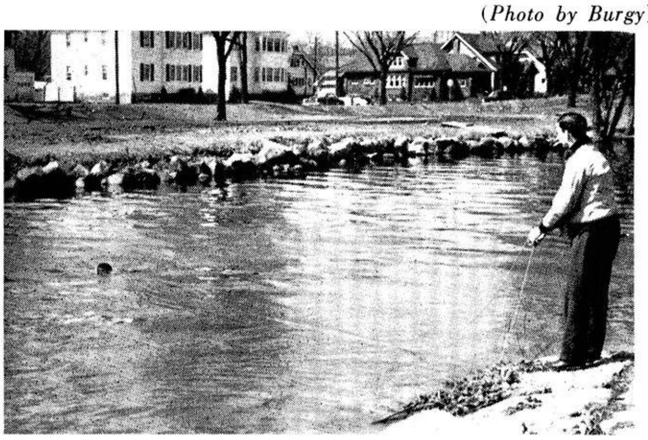
In the past, the main method of curbing algal growth was through the application of copper sulphate to the water in the spring. But this has not proved to be a satisfactory solution to the problem.

The concentration of those materials favorable to the growth of algae is even greater in the three lower lakes, being greatest in Lake Waubesa, into which the Madison Nine Springs Sewage Treatment plant effluent is discharged.

The effluent is of satisfactory quality from the standpoint of organic pollution, but it contains relatively large amounts of soluble phosphorus, nitrogen, and possibly other plant foods. As a result of the greater fertilization of these lakes, the growth of algae is correspondingly greater.

Offensive odors from Lake Mendota have been known to occur as early as the 1850's. At one time during that period the stench became so obnoxious that several resi-

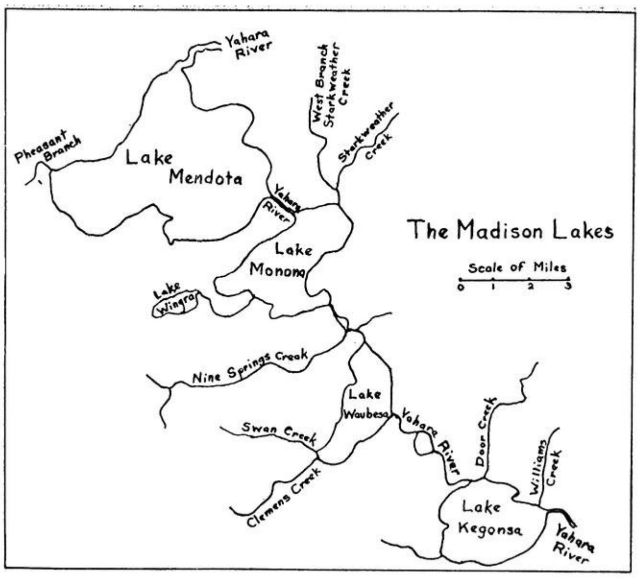
(Photo by Burgy)



Water sample being taken from the Yahara River above Lake Monona.

dents of Langdon Street were forced to move. The first known study of the nature of the problem was begun in 1882 by several professors from the University of Wisconsin. Since then investigations have taken place from time to time, but with few results of practical significance.

The present intensive study of lake conditions, and a search for possible remedies, were begun in 1941 when the Governor appointed a committee to make studies of the three lower lakes. In 1945 studies of the problem were begun in and around Lake Mendota by the University of Wisconsin. President Fred appointed a Lakes Investigations Committee to supervise research on the subject. In general, funds are being provided by the Wisconsin Alumni Research Foundation and the Thomas Brittingham Fund. The project was broken down into several branches, with Dr. W. B. Sarles, professor of agricultural bacteriology, acting as coordinator.



What Is Being Done?

The sanitary engineering department is conducting a study of the origins, quantities, and disposition of fertilizing materials tributary to Lake Mendota. It is evident that the run-off from the surrounding agricultural lands is an important source of natural pollution. Therefore studies are being made of the effect of reducing erosion by soil conservation methods upon the amount of nutrients discharged by these lands.

The amount of pollution entering the lake from streams is measured by gaging the flow of streams discharging into Lake Mendota at each of ten stations on the streams. The water at each station is sampled and tested weekly to determine its content of soluble phosphorus and total phosphorus; nitrates, nitrites, ammonia, and inorganic nitrogen; sulphates; iron; manganese; silica; dissolved oxygen; and its biochemical oxygen demand, alkalinity, and pH. Samples are also taken at a series of stations in line with certain stream mouths and extending from the streams out into the lake to determine the effect of weed beds and algae concentrated near the stream mouths on the concentration of nutrient materials originally in the stream.

A vertical series of sampling stations has also been established to analyze the water at the surface, at the thermocline (about ten meters depth), and half a meter from the bottom. A final sampling and gaging of flow takes place at the Yahara River as the water leaves Lake Men-

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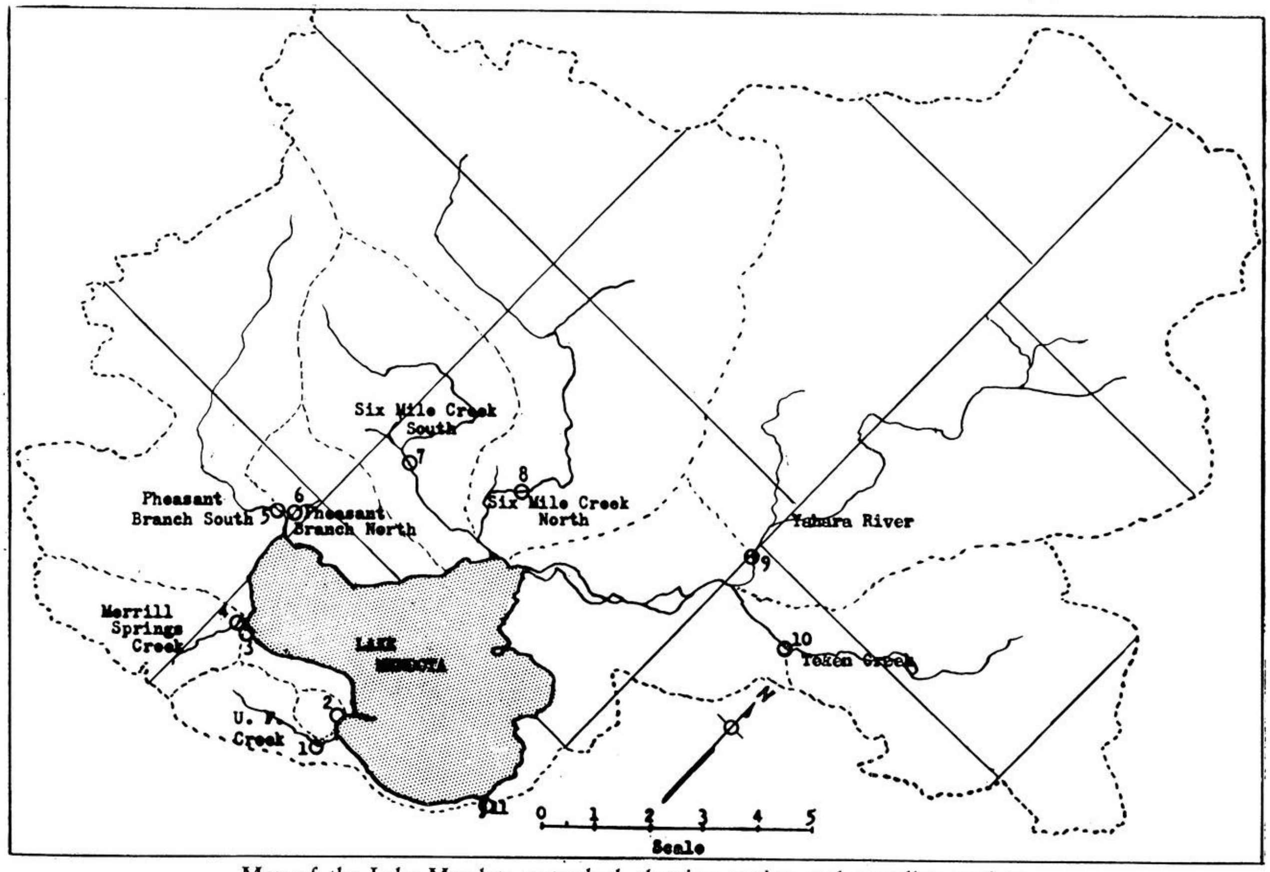
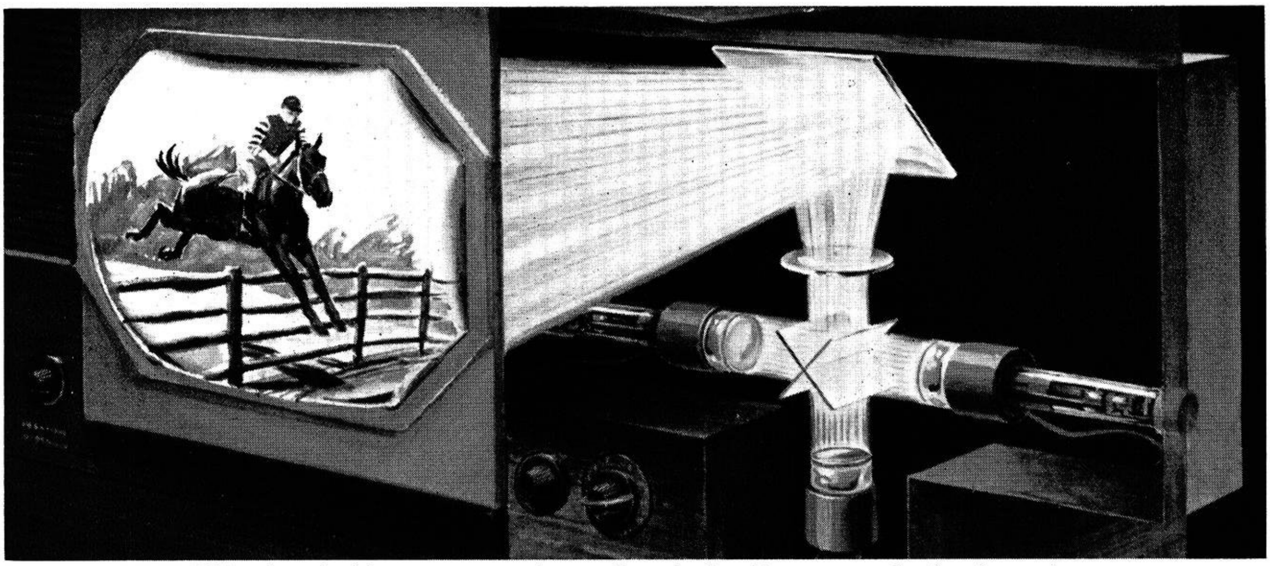


Map of the Lake Mendota watershed, showing gaging and sampling stations.



RCA color television converter, using small projection kinescopes and refractive optics.
(Photos courtesy RCA)

The future use of color television seems certain. Recently, several methods of color transmission were presented to the Federal Communications Commission for study. The purpose of each system was the adoption of one standard method of televising colored pictures. The FCC, before making its decision, has emphasized that it is primarily interested in a system that can operate within the present 6 megacycle bandwidth and will permit reception on the ordinary television receiver with relatively minor modifications.

The introduction of color will present some new problems, as was realized by the FCC in the Fall of 1948, when they "froze" the licensing of new stations. Besides the new standards which color television would necessitate, it was evident that the twelve television channels then in use were pitifully insufficient and new ultra-high frequency allocations would have to be made.

Basically, the transmission of color is not much different from black-and-white television. For that reason, let us consider the fundamentals of a monochrome system. The scanning of the cathode-ray tube to produce the picture is fundamental. The scanning spot in the receiver moves from the upper left corner of the screen as in reading a printed page, but it skips every other line.

After each horizontal line is scanned, the tube is cut off so the trace in returning to the left side of the tube does not leave a streak. Also during this instantaneous period while the spot is flying back, the next horizontal line is synchronized by a pulse so that it stays in step with the scanner at the transmitter camera.

When the spot reaches the bottom of the screen, the picture tube is made inoperative for an instant, and the spot flies back up to the top center of the picture and rescans the entire picture between the lines previously scanned.

Each field scan takes one-sixtieth of a second, or for two fields which constitutes an entire picture the time would be one-thirtieth of a second. Due to this interlaced scanning, however, the flicker frequency is 60 cycle rather than a distracting 30 cycle flicker which would result if the entire picture were scanned in one field. This complicated scanning process is in addition to the persistence

FOR YOU:

Color Television

by donald r. smithana, e'50

of the eye in eliminating any mosaic appearance of the picture.

The number of horizontal lines scanned per field is 262.5 and for two fields or one picture frame that is, of course, the standard 525 lines. The number of lines in a frame determines how high the definition of the picture will be.

For the actual transmission of color television, there are two basic methods. They are the sequential and simultaneous systems. In the sequential method, the different colors are transmitted one at a time in succession. This would call for 6 fields per frame, two for each of the three primary colors. The CBS method of color transmission is of this type. It has been termed a "mechanical" system, a misnomer in view of the fact that while mechanical elements are used, it is still preponderantly electronic.

Because of the increased number of field scans required to produce a color picture, the field frequency has been increased to 144 fields per second. For the three colors, this gives a color frame 48 times a second. Due to interlacing (two field scans for each color in order to scan both odd and even lines) the complete color picture is reproduced 24 times a second.

For the production of color, this system involves the use of a motor driven wheel which successively inserts color filters of the three primary colors. This arrangement is at both the transmitter and receiver, both motors being carefully synchronized with each other. In effect, this system consists of picking up everything that is red and sending it out as if it were white to a receiver which reproduces the white image on a cathode ray tube where it has a red filter momentarily in front of it. The next instant a blue frame is sent in a similar manner and then a green frame. This occurs so rapidly that the eye receives it as one complete color picture. An advantage here is that only one cathode-ray tube and its associated electron gun is needed.

In the simultaneous system, as employed by RCA, all three primary colors are picked up and transmitted as each line is scanned. The system makes use of three outputs from the camera, one for each of the primary colors. Each of these outputs is sampled (or fed into the transmitter) 3,800,000 times a second. The time between successive samples of the same color is 0.263 microsecond (0.263 equals 1/3.8). Any one color takes up only one-third of this time. That is, after a red sample is taken, at a time .0877 microsecond later a blue sample is taken. In this way all three colors are transmitted within a .263 microsecond interval. Besides using an interlaced field as described for black-and-white, RCA employs picture dot interlacing. This is rather a masterpiece of "split microsecond" timing and synchronization.

Four fields are used as contrasted with two as in black-and-white. The first field scans every other line of the picture laying down a series of green dots with the space between them occupied by red and blue dots at the same time, with great overlapping of dots. When the second field scans the lines between those of the first field, it is synchronized to place every colored dot between dots of th other two colors which are in the line above it. The third and fourth fields are similar to the first two except that now it places the colored dots on the same line between the dots representing the other two colors.

It is of importance to note that these dots laid down are only assumed to be on one screen for simplicity. In the present RCA system, the pulses representing each color are separated and sent to their respective cathode-ray tubes. For reproduction of three colors, the phospors on the three viewing screens would be red, blue, and green. These tubes can be projection type or direct view. Both types make use of dichroic mirrors which will reflect one color and pass others. The arrangement of the kinescopes

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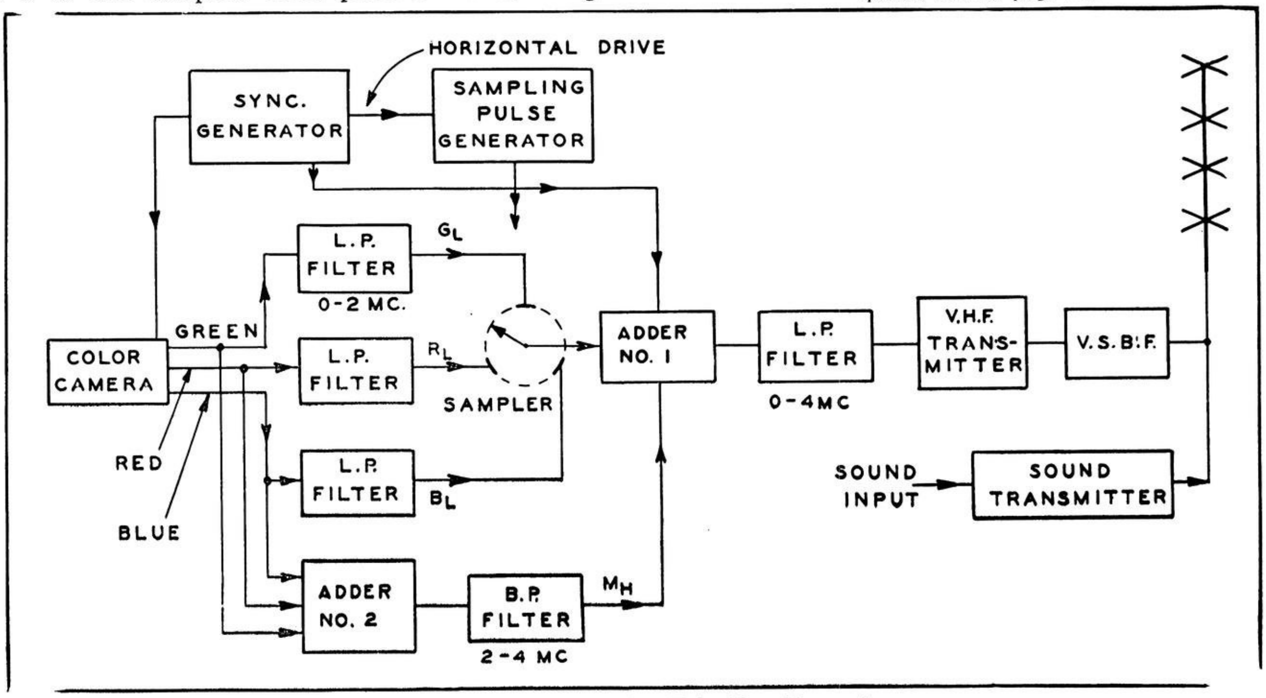


Block diagram of the Color Television Transmitter.

ON *the Campus*

by john f. mcCoy e'50

Most of the pictures on this page were taken on the senior inspection trips. Chicago, and several EE's, will never be the same again. The large picture, directly above, shows a few of the students in the Museum of Science and Industry. Left to right, they are M. Raddeman, R. Hoenfeldt, M. Kirchmayer, R. Krueger, A. Seidel, and R. Unrath. The center picture on the right is an exterior view of the Museum of Science and Industry, and the top picture shows a group of EE's in the Zenith Radio Corporation.

The last picture was taken at the University of Minnesota, where several of the staff members of the **Wisconsin Engineer** attended the ECMA convention. From left to right: A. Nemetz, R. Dickenson, J. Ashenbrucker, and H. Sieth.

Science Highlights

by donald miller, m'50

TOUGH TUBES

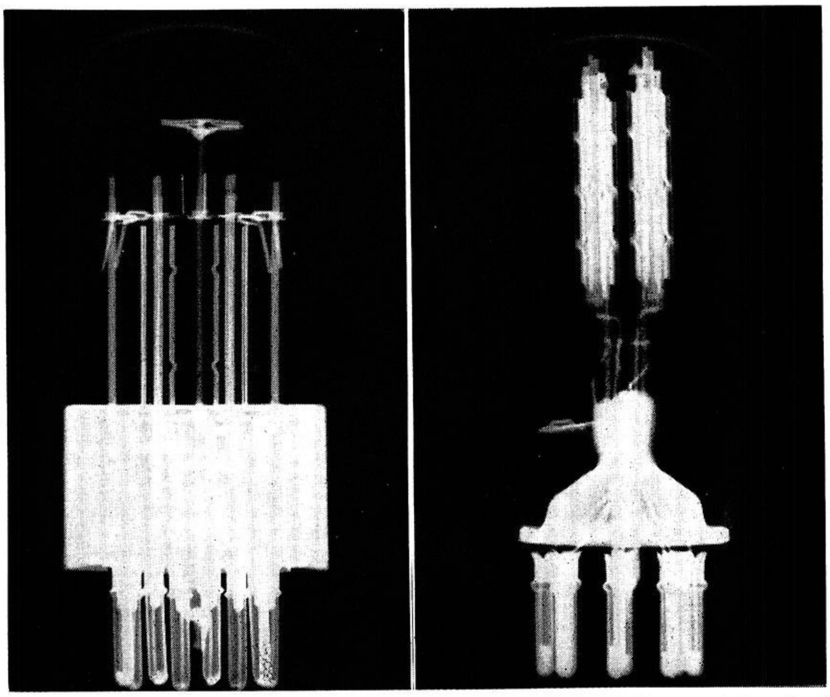
Rugged electron tubes for industry and special purposes are now being produced. The tubes will function perfectly although subjected to severe conditions of vibration, shock, and acceleration. At the National Bureau of Standards, not only are new types of rugged tubes being developed, but adequate test methods are being studied.

The development of a rugged electron tube is a good example of the interdependence of testing and design. The creation of a rugged tube is brought about through a series of successive approximations.

First the mechanical tests are applied to the tube, determining the ways in which the tube fails to meet the ruggedness requirements. A preliminary revision of the tube design is then made, the experimental model being made in the model shop. The same tests are then applied to the experimental tube, usually indicating a vast improvement over the commercial type. The procedure is carried on until a satisfactory tube in all respects is produced.

There are many different types of mechanical stress that a tube may be subjected to, the most common being mechanical vibration such as that produced in vehicles, in aircraft, on shipboard, and in industrial applications.

The tubes are often tested by continuous vibration for periods of several days to produce fatigue failures at the points of weakness. These failures are most likely to occur in the filaments, cathode coatings, and poorly welded or soldered joints. Grid and plate seldom exhibit fatigue failures.



(Photo courtesy National Bureau of Standards)

The old—and the new—electron tubes.

The most severe effects are found when a tube resonates at a certain frequency. The electrical noise produced may be large enough to override the signal, and the oxide coatings of cathodes will often flake off. To prevent resonance it is best to design the tube so that the natural frequencies of the elements are higher than those met in practice. This is done by using stiff materials, shortening the structure, and increasing cross sections for greater rigidity.

Impact tests are also made. In this type of test the common failures are shattering of the glass envelope and breaking of brittle parts. The tests conducted range from instantaneous accelerations of fifty to several hundred times the acceleration of gravity.

High acceleration conditions for long periods of time are encountered in many high speed devices. A centrifuge is used to produce accelerations up to several thousand times the acceleration of gravity. The common defects revealed by this type of test are breaking of welds, bowing of elements, and shorts.

The use of all of these tests show much about the structural design of a tube. It is expected that as more is learned about production methods and materials applicable to rugged tubes all preferred types will be available in ruggedized form.

FIRE PROGRESS DETECTOR

Progress of one of the largest man made fires in history, burning underground in a coal vein near Birmingham, is being followed by means of an electronic mercury vapor detector.

At regular intervals through the vein, small capsules of mercury have been placed. A mercury vapor detector, developed by the General Electric Company, keeps a constant check on the gases pouring through the mine. When the fire reaches the mercury capsule, the mercury is vaporized, the detector indicates the fact, and progress of the fire is then determined.

The mercury vapor detector makes use of the fact that ultraviolet light is scattered when it

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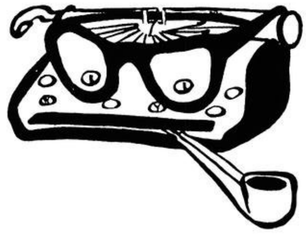

A Sad Sack Engineer
Guest Editorial

The Way We See It

There are those young idealists, yet in school, who visualize the engineering profession as the perpetual creative trance. There are a few who have graduated and found this to be true. There are others who have graduated and found that it is hard work, perhaps even interesting work. But let me introduce you to the lad who found none of these.

Woe, grief, misery, strife—
Nothin' but trouble
All my life

is his motto. And with good reason; he is a troubleshooter.

What sort of strange animal is the troubleshooter? Why is his lot such a sorry one? Why does he not change to a more affable profession? These, with other interesting questions, will be answered in this dissertation—straight from the horse's mouth.

You see, I was a troubleshooter.

How does it happen that a pure, red-blooded, all-American boy can get into such a mess? Well, Joe Woe is a typical example. He walked into an interview one fine day and said, "I want a job that is a **challenge** (his emphasis); a job that will give me some broad experience; a job that—"

This is as far as Joe got. The interviewer rose and boomed: "Well, well, my boy. Welcome to the XO Corp.!! Glad to see you coming around. I like a man who knows how to take a knock now and then."

Since it sounded like praise, Joe smiled hopefully in reply. In later years, Joe became very adept at the hopeful smile. At this point another stranger jabbed his head into the room. "Chief!!" he shouted. "Number three just blew its stack!!"

"What's a number three?" Joe asked.

The Chief was no longer quiet. "What do you think I am paying you $200 per month to find out?" he queried.

So Joe found out. Joe found out a lot of things in the next few years. They were that:

a. Maintenance men hated him, because he infringed on their jobs.
b. Production men hated him, because he took too long to dress at three o'clock in the morning.
c. Production men hated him, because he recommended preventive maintenance when their equipment was running fine.
d. Maintenance men hated him, because he recommended replacing parts before they fell apart, thus interrupting well-earned pinochle games.
e. Purchasing and Accounting hated him, because he never had time to send his requests-to-purchase through the regular five-day, streamlined channels.
f. And dogs **liked** to bite him. They got a real kick out of it.

Joe learned not to mind eating alone in the company cafeteria. He didn't mind that conversations stopped when he entered the room. He didn't mind when he was thrown out of the Chief's office, after suggesting a change in the design of Number three. (Joe didn't mind too much, because he and Number three were on pretty intimate terms by then).

Joe became pretty good in his field. He practiced long hours in front of a mirror—scowling back. He developed ulcers, which helped bring out this natural talent. He tried the hopeful smile until he had the most pathetic visage in the plant. He could turn it on and off like water. An artist.

But one day it happened. An ugly rumor began to circulate through the Cost Control offices. Finally the Cost Chief called Joe into his office.

"@φ★—θ√) (*!," he said. "What is the function of a troubleshooter?"

Joe had a dandy answer for that one, but before he really got started Cost Chief cut him off. "I have suspected for some time that your attitude could stand some looking into; but be that as it may, let **me** tell **you** what the function of a troubleshooter is. The function of a troubleshooter is to shoot trouble. And this plant no longer has any trouble."

Joe thought a moment on this subject, but was jerked back by the next observation.

"And a plant that has no trouble has no use for a troubleshooter. Right?" The last was snapped at him like a cable with a 0.2 safety factor.

"Well," Joe began slowly. Too slowly.

"@φ★—θ√) (*!, you're fired."

So Joe left the XO Corp. He spends part of his time outside the gates of the XO Corp., listening to the steady, maddening rhythm of Number three. Part of his time he spends in the park on that sunny bench over by the "Feathered Friends Smorgasbord". The rest of his time he spends in his room — third floor rear — sanding the woodwork very carefully to get fuel for his little grate.

But he is happy. He has had a full life. His career was a **challenge,** and it was a broad experience.

As for the questions I set out to answer so long ago, the troubleshooter is just like you and me—but he opened his mouth and said, "I etcetera—" once too often. And he doesn't change to a more affable profession because he can't get enough time away from his job to look for another.

Diesel Engine

education

For The Future

by walter s. brager, m'50

American Industry is becoming increasingly aware of the fact that engineering colleges are producing an important industrial tool,—engineers who design, build, sell and perform the many jobs vital to industry's existence.

Evidence of this awakening was displayed at the Diesel Engine Manufacturers Symposium held on the University of Wisconsin campus, August 29 to September 3, 1949. The Diesel Engine Manufacturers Association, recognizing the importance of well-trained engineers to the advancement of diesel engines, launched a program to improve the product of engineering colleges.

A six year plan was formulated and was initiated two years ago with a symposium at Pennsylvania State College. The Symposium provided a more definite and intimate contact between teachers of engineering and practicing Diesel Engineers from the field.

In addition to the symposium held each year, the Association activated a progressive educational program which is designed to improve and modernize diesel engine textbooks, laboratories and courses, and to help professors keep abreast with the latest technical developments of the industry. The diesel engine industry has advanced so rapidly during the war and the immediate post-war period that the existing text books and courses of information lag far behind the present stage of industrial development.

In an effort to correct this condition, the Diesel Engine Manufacturers Association has from time to time prepared and sent to schools bulletins containing information which will help them do a better job of teaching. In addition, the Association is having a series of pamphlets prepared covering such subjects as: Intake & Exhaust Systems, Lubrication, Injection, and Combustion. These will be written by educators with the aid of engineers from industry, and will furnish the basic material for incorporation into the text books of tomorrow.

An effort is being made to aid colleges and universities in obtaining adequate laboratory equipment. Since the close of the war our schools have obtained from Government Surpluses more than $6,000,000 of diesel equipment. In many cases the balance is bad and in others there is a lack of instrumentation and sound planning for the use of the available equipment.

To alleviate these conditions, an equipment auction was held at this year's Diesel Engine Symposium, which provided a round-table trading period where those attending could offer for trade laboratory equipment, which they do not need, for something another school has, but does not need. Thus, through a process of re-allocation of equipment, the schools can obtain a more representative supply of laboratory apparatus.

The improvement of courses in diesel engines stems from some of the topics of discussion at symposiums. For example, at the symposium this summer these subjects were discussed: "Procedures and Equipment Used in Stress Analysis in the Diesel Field," by F. G. Tatnall, the Baldwin Locomotive Works; "The Correlation and Presentation of Diesel Engine Performance Data," by C. F. Taylor, Massachusetts Institute of Technology; "The CFR Engine and How It May Be Applied to College Laboratory Work," by Arthur W. Pope, Waukesha Motor Corp.

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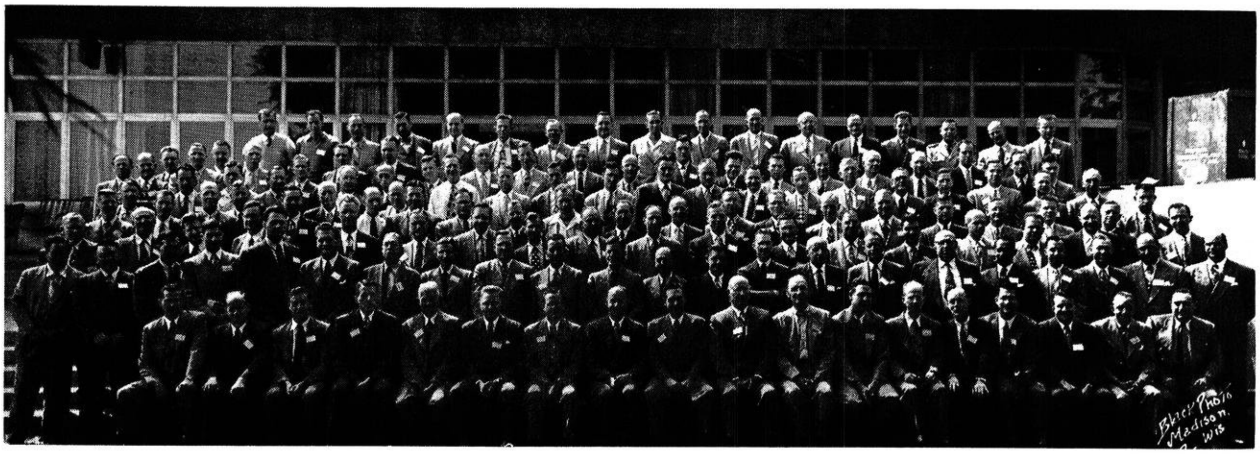

Diesel Engine Manufacturers Symposium, University of Wisconsin

Alumni Notes

by hank williams, e'50

C.E.

James E. Bamberry, ('28),, is reported to be with a company at Kaukauna, Wisconsin, which operates a line of barges on the Fox River.

Ivar G. Van Akren, ('29), is reported to be on the staff of the Waterways Engineering Corporation of Green Bay, Wisconsin.

Wayne G. Bryan, ('33), resigned as City Engineer at Neenah to accept the position of director of public works at Portage, Wisconsin.

Charles O. Clark, ('34), is living with his family in Caracas, Venezuela, where he is under contract with the Ministry of Public Works as a Consultant on hydraulic engineering problems.

Edwin J. Voss, ('37), died on May 27 in a Madison hospital. He had been ill for several months. He is survived by his wife and two children.

John L. Dollhausen, ('40), has resigned his position as structural designer with the Dupont Company at Niagara Falls to work with C. D. Smith & Sons, Contractors, at Fond du Lac, Wisconsin.

Stanley R. Nestingen, ('40), has been appointed roadmaster at Madison, Wisconsin, for the Chicago & North Western Railway Company.

Glenn F. Finner, ('41), died on February 17 while undergoing an appendectomy at Knoxville, Tennessee. He is survived by his wife, Pauline. He had worked for TVA and at the Oak Ridge plant. He taught for two years at the University of Tennessee. At the time of his death he was with the Wilson-Weesner - Wilkinson Company as structural detailer.

Richard W. Andrae, ('46), has received his master's degree and has resigned as instructor in mechanics to accept a position as construction engineer with The Texas Company at New York City.

E.E.

Robert St. John is employed at Peer, Incorporated, of Benton Harbor, Michigan, a firm making electrical welding equipment and communication equipment. The firm was formerly known as The Pier Equipment Manufacturing Company.

James M. Evans, (MS'49), recently started work for the Standard Oil Company of Ohio at Cleveland.

The following men are recent graduates who have applied for the ranking of Associate of The American Institute of Electrical Engineers:

Theodore Berstein, is working for the Boeing Airplane Company of Seattle, Washington.

William Carl Oswald, is an electrical engineering trainee for the Oliver Iron Mining Company of Duluth, Minnesota.

David M. Holaday, is employed at the Wisconsin Electric Power Company of Milwaukee, Wisconsin.

Thomas H. Toben, is an Electrical Engineer for the United States Bureau of Reclamation at Coulee-Dam, Washington.

William Hart Nash, is with the Line Material Company of South Milwaukee, Wisconsin.

Miss Jane M. McKenna, is in the Publications Department of Fairbanks, Morse and Company of Beloit, Wisconsin.

Richard Krauss, is a test engineer for the General Electric Company at Schenectady, New York.

M.&M.

John Althouce, ('49), is a Mining Engineer for the Oliver Iron Company of Hibbing, Minnesota.

James D. Morrison, ('49), is employed with the Pickards Mather Company of Hibbing, Minnesota.

David P. Smith, ('49), is working for the Oliver Mining Company as a Mining Engineer.

The following men are trainees for the Shell Oil Corporation. In receiving their training, each of these men have been stationed in many parts of the country. They are all Mining Engineers of the class of 1949.

Joseph H. Loeb, Edmond V. Peirson, Robert L. Smith, William F. Sporleder,, ,Jay R. Dodge, John E. Springborn.

Harry R. Raschke, is a loop-course student for the Bethlehem Steel Company.

Robert D. Dustrude, ('48), is a Mining Engineer for the United States Gypsum Company of Louiston, Montana.

Donald S. Colbo, (MS'48), is a Junior Production Engineer for the Shell Oil Company at Tulsa, Oklahoma. He recently returned to the Wisconsin campus for a visit.

Let's get down to earth . . .

IMAGINE stealing three billion tons of earth every year! That's what soil erosion has been doing. And this gigantic theft has cost farmers billions of dollars. For good earth is *not* dirt cheap.

"Stop erosion!" has become the farmers' war cry. Agricultural agencies have joined the farmers. Together, they have turned to the farm machinery makers. They've asked for bigger and better bulldozers, tractors, graders for necessary ditching and terracing. But to build this super farm machinery takes tougher steel, *new alloys.*

Here is where UCC enters the allied offensive against erosion. Drawing on its vast engineering experience, UCC contributes modern metallurgical techniques and alloys. This co-operation with steel manufacturers helps the farm machinery makers . . . who then are able to give the farmers the equipment they need.

How is the "war" going? The farmers are winning. Dust bowls are vanishing. Sterile lands show signs of life. Yes, the farmers are winning their fight against soil erosion with a combination of new equipment, revegetation and crop rotation.

Union Carbide is proud of its part in this effort. And the people of UCC stand ready to help solve other problems . . . wherever better materials and processes are needed.

FREE: *You are invited to send for the new illustrated booklet, "Products and Processes," which shows how science and industry use UCC's Alloys, Chemicals, Carbons, Gases and Plastics.*

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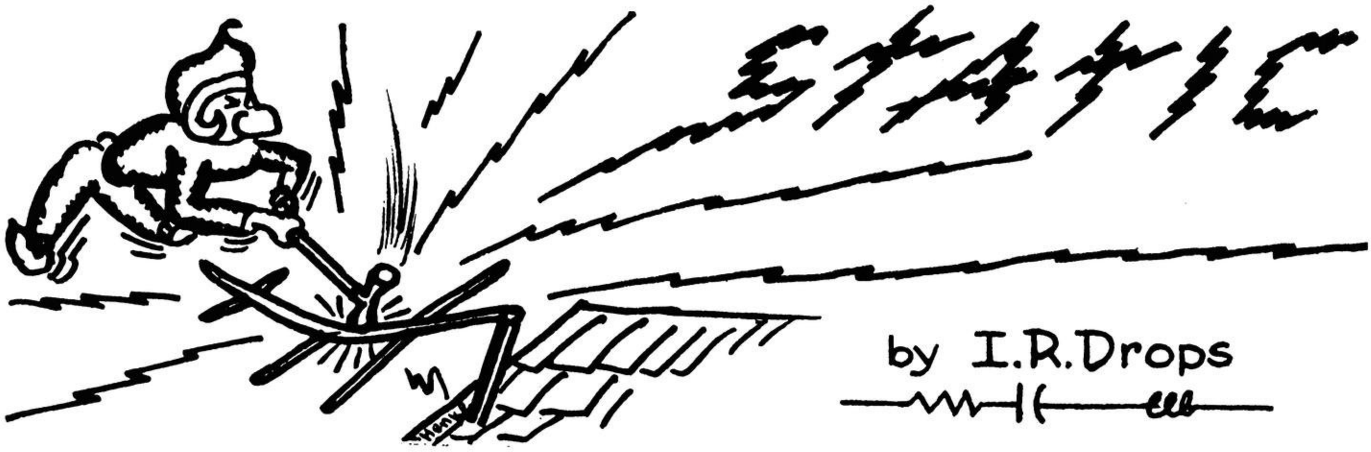
PRESTONE and TREK Anti Freezes • NATIONAL Carbons • EVEREADY Flashlights and Batteries • ACHESON Electrodes



Little Willie
Feeling fine!
Stole his father's favorite wine,
Mother seeing he was plastered
Cried: "Go to bed you little
booze-hound."

* * *

Daffynitions

sinema—a wicked movie
stewdent—inebriated ILS scholar
partender—a saloon employe who works only half time

* * *

They're picking up the pieces
With a dustpan and a rake;
He grabbed a silken knee,
When he should have grabbed the brake.

* * *

A local preacher has recently announced that there are 726 sins.

He is being beseiged with requests for the list, mostly from ILS students who think they are missing something.

* * *

Is that little Bessie Marters?
A rosy smile upon her lips . . .
But mousetraps on her garters.

* * *

A naturalist is a guy who always throws sevens.

* * *

Two drunk lawyers blundered into Elizabeth Waters hall on the way home. One lost his head and ran, the other remained calm, and collected.

* * *

It's late, it's dark.
The house is dim.
Daughter's boy friend
Must still be in.

Mother to daughter coming in late: "What makes your right shoe muddy and not your left?"

Daughter: "I changed my mind."

* * *

The height of bad luck—seasickness and lockjaw.

* * *

Since we call professors "prof", it's easy to figure out what we ought to call assistants.

* * *

A traveling buyer had been on a trip for three months. Every few weeks he'd send a telegram home to his wife saying: "Can't come home. Still buying."

The wife stood it for a while, but when the fourth month started, she decided to do something. She sent him a telegram. "Better come home. I'm selling what you're buying."

* * *

There was a young lady from Kent,
Who said she knew what it meant.
When men asked her to dine,
Gave her cocktails and wine;
She knew what it meant, but she went.

* * *

Then there was the girl who soaked her strapless evening gown in coffee so it would stay up all night.

* * *

Prof: "Here's an argument from nature. If you lead a donkey to a pail of water and a pail of beer, which will he drink?"

M.E.: "The water."

Prof: "Right. Why?"

M.E.: "Because he's an ass."

Kid Brother: "Give me a nickel or I'll tell Dad that you held hands with my sister."

E.E.: "Here you are."

K.B.: "Give me a quarter or I'll tell him you kissed her."

E.E.: "Here, pest."

K.B.: "Now give me five dollars!"

* * *

"I'm going to have a little one,"
Said the gal, gay and frisky;
But the boy friend up and fainted
Not knowing she meant whisky!

* * *

Applicant: "I'm Gladys Zell."

Personnel Manager: "I'm happy myself. Have a seat."

* * *

Marriage is an educational institution in which a man loses his bachelor's degree without acquiring a master's.

* * *

"When my girl isn't thirsty or hungry . . . she's asleep."

* * *

Englishman #1: "Sorry to hear you buried your wife, old man."

Englishman #2: "Had to, dead you know."

* * *

"I want a corset for my wife."
"What bust?" asked the clerk.
"Nothing. It just wore out."

* * *

The difference between progress and congress is pro and con.

* * *

The new French bathing suits come wrapped in a summons.

* * *

Marriages were invented in heaven but, unfortunately, the process was not patented.

Education-diesel engines

(*continued from page* 17)

Further improvement of courses is made possible through the supply of instructional aids; such as films, literature, charts and speakers made available to colleges by the companies participating in the program.

The Diesel Engine Manufacturers Association is also interested in the professors who teach the courses in diesel engines, for these men control the quality of the college product which the diesel engine manufacturers buy. The educators are assisted in improving themselves by the provision of conferences and symposiums to discuss the latest technical developments and problems of mutual interest.

Typical of the material presented for this purpose are the topics which were discussed at the 1949 symposium: Fuel Injection and Equipment Problems, Application of Gears to Diesel Engines, Engine Cooling Problems and Equipment, Diesel Engine Operation and Maintenance, Pistons and Piston Rings, Bearing Design and Research, and Fuels and Lubrication of the Diesel Engine.

To further the effort to keep the instructional staffs informed, the Association has planned visits to diesel manufacturing plants and has offered teachers opportunities for summer employment with the aim of providing a more practical background for instruction.

The views of the Diesel Engine Manufacturers Association were summed up in a statement to the press by Harvey T. Hill, Executive Director, **"We are trying to improve the product that we get from the nation's colleges and universities. Frankly, some of the boys we hire are not very good and we're spending some time to tell the schools what we want. We're suggesting new text books, improved courses and modern laboratory equipment. We're also getting the professors together in programs such as this (the symposium at the University of Wisconsin) so we can work out diesel problems together. Then the educators can appreciate what the industry is up against, and what it requires from its engineers. The trouble with some professors is that they have had no practical experience in industry."**

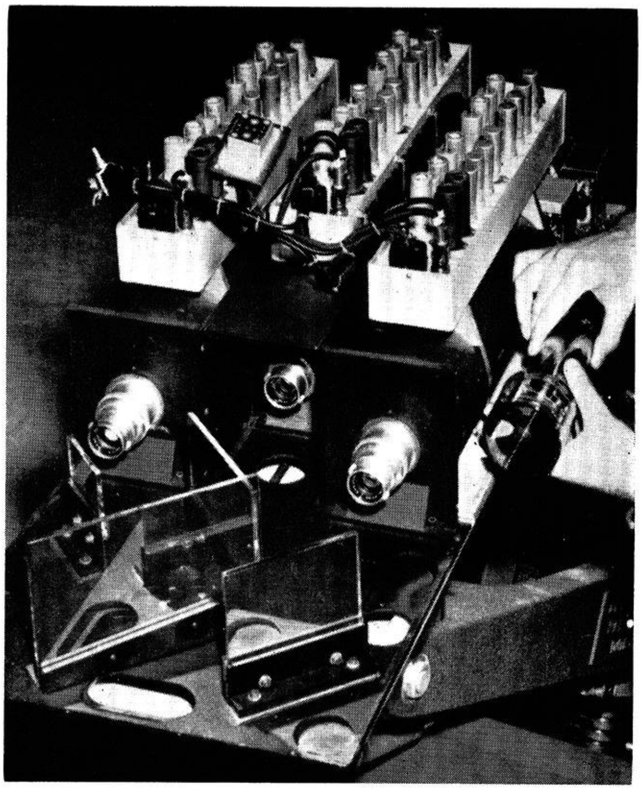
This is a challenge, not only to the educational system and the educators, but to the students as well. It is an opportunity for the professors to prove that they have not bogged down in the mire of academic routine, but that they are actually surging ahead toward the goal of better engineering colleges. However, the measure of success of this program is not merely the attendance at the symposiums, which was 200 at this year's meeting in comparison to 37 at the Pennsylvania State College Symposium two years ago, but also the quality of the engineers leaving college and entering industry. This quality can rise only through the full cooperation and combined efforts of student and faculty. A better college today means a better world tomorrow.

Color T-V . . .

(continued from page 13)

and dichroic mirrors is shown in the photograph.

It is desirable to use as little bandwidth as possible in a television system. For this reason, in the simultaneous system use is made of time-multiplexing techniques. That is, instead of signal pulses from the three color pickups being sent at different frequencies, they are sent at different times as mentioned previously. An electronic commutator is used, called a sampler.



RCA's Color T-V Camera showing the arrangement of the dichroic mirrors in front of the image orthicon tubes.

At a particular instant of time the output of the transmitter represents one color and if the receiver is properly synchronized, it will be ready to translate that pulse into its proper color determined by the time the pulse occurs after a standard synchronizing pulse.

In color as in black-and-white, after each horizontal line is scanned a synchronizing pulse is sent out by the transmitter to keep each horizontal line at the receiver in step. The number of synchronizing pulses per second would be equal to 525 lines per picture times 30 pictures per second or 15,750 square wave pulses per second. The sampler, through the use of a differentiation circuit, makes use of the trailing edge of each pulse to time the sampling of each of the color signals.

An important recent development which is used by RCA is the principle of mixed-highs. The video signal output of the camera extends from zero to four megacycles. However, the higher end of this band is accentu-

(please turn to page 32)

Progress and T-25

(*continued from page 8*)

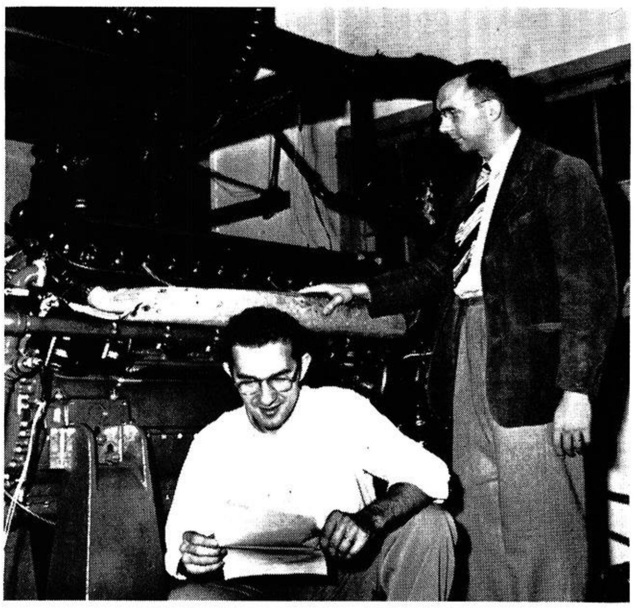
OTTO COMBUSTION

Aims and instrumentation for the Otto cycle project are similar to those for the Diesel; one outstanding exception exists, however. While Diesel combustion is luminous, Otto combustion, under normal conditions, is nonluminous, so that the Otto "flame" must be colored artificially as a prerequisite to temperature instrumentation; to this end, a concentrated sodium compound is introduced in minute quantities. It has been proved that fuel adulteration of this type has no pronounced effect on combustion.

Optical Pyrometer

A special Sodium Line Reversal Pyrometer records instantaneously and continuously the temperature of this sodium compound which occurs in thermal equilibrium with the rest of the combustion chamber gases. Radiation from a sodium vapor lamp, directed through the combustion chamber by two quartz windows, provides a comparison base for absorption measurements. After passing through a spectrometer, this light is compared by a photo tube bridge system with light "viewed" directly from the sodium vapor lamp.

If the combustion gases at a certain instant are at a lower temperature than the lamp, then the sodium particles in the gases will absorb more radiation than they emit. If, on the other hand, the gases are at a higher temperature than the lamp, the sodium particles will emit more radiation than they absorb. However, if the temperatures are equal, radiation from the gases will equal absorption; under this condition, the apparent temperature of the lamp equals the true temperature of the flame. Inverse feedback from the photo tube circuit to the lamp-current source maintains this last condition instantaneously and continuously.



STEADY FLOW COMBUSTION
V. V. Holmes, A. J. Pahnke

Lamp radiation intensity is measured by another photo tube circuit which is connected to the vertical deflection plates of a cathode ray tube so that the indication is temperature vs. crank angle.

STEADY FLOW COMBUSTION

The primary interest in this project lies in the realm of fuels and instrumentation for steady flow combustion engines. Combustion of this type occurs in gas turbines, jet engines, and ram jets. It is hoped that, concurrent with a better understanding of the combustion process, will come extension of the useful velocity limits of burners.

A flame in a high velocity air stream may be torn apart by pulsations. While increases in the velocity of flame propogation may appear with advances in the field of fuel technology, present research is directed mainly toward the problem of decreasing air stream velocity in the vicinity of the flame, and increasing flame turbulence for better combustion.

Equipment

A 12 cylinder V171019E22 Allison aircraft engine of 1050 bhp powers two paralleled superchargers which supply high velocity air flow at the rate of 12 lbs. of air per second at a pressure of 2.5 atmospheres. This air, if exhausted to the atmosphere through a wind tunnel of 10 square inch cross-section, would yield a stream velocity of 1750 miles per hour.

The apparatus may be made available for aerodynamic studies.

Instrumentation

Instrumentation is designed to supply data for the solution of the following thermodynamic equation:

$$\frac{dQ}{dX} = cp\left\{ \frac{ft}{m}\left[\left(\frac{Pt}{P}\right)^{\frac{n-1}{K}} - 1\right] + \left(\frac{K-1}{K}\right)\frac{T}{P}\,\frac{dP}{dX} + \frac{dT}{dX}\right\}$$

Where:

X = distance measured along the chamber axis.
Q = heat units added.
cp = specific heat.
f = friction factor.
T = static temperature.
m = hydraulic radius.
Pt = total pressure.
P = static pressure.
n = constant in pvn = k.
k = cp/cv.

INDICATED MEAN EFFECTIVE PRESSURE INDICATOR

This instrument is intended to satisfy the need for a device which will provide continuous imep or ihp readings during operation, and to obviate the present necessity for taking indicator cards. The operator may note performance changes immediately, and correlate this information with external effects. Effectively, the apparatus provides a continuous solution to the power formula,

$$P = \text{integral of } p\,\frac{dv}{dt} \text{ from } t = o \text{ to } t = T$$

(*please turn to page 30*)

Van Hagen . . .

(*continued from page 9*)

of faculty members who attended the two months SATC training at Fort Sheridan.

He was active in securing passage of the legislative act that established the registration of Professional Engineers in Wisconsin in 1931, and served as a member of the Registration Board for ten years.

He served as president of the Engineering Society of Wisconsin and also as president of the University Club (1927-28). He presided as director of the Wisconsin Alumni Association and was chairman of the membership committee for a considerable time. During this period, the senior classes made a practice of joining the association in a body. Many other college and university committees have come under his able leadership.

Professor Van Hagen is a Registered Professional Engineer in Wisconsin. He belongs to Tau Beta Pi and Chi Epsilon, two honorary societies for engineers. The professional societies of which he is a member are the American Society of Civil Engineers, American Railway Engineering Association, and the American Society for Engineering Education.

Professor Van Hagen's connection with the "Wisconsin Engineer" has always been of a helpful nature. Except for a brief period of two years, he was a member of the Board of Directors from 1918 up to the time of his retirement. He was Director and Advisory Editor from 1917 to 1918 and Chairman of the Board from 1918 to 1923.

Professor Van Hagen was active with the Engineering College Magazines Association. He attended the meeting at Chicago, Feb. 26, 1921, at which ECMA was organized and the Constitution and Standards of Practice were adopted. He was Chairman of ECMA from 1924 to 1928. It was during his regime that the organization finally got squared away; after some vigorous action!

The entire Van Hagen family are leaders. Mrs. Van Hagen was president of the Madison Woman's Club from May 1947 to May 1949 and may still be carrying on in that capacity.

The oldest son, Robert, is now chief engineer of the Lehon Co. at Wilmington, Illinois. He was a University of Wisconsin graduate of the class of 1932. He has two sons and one daughter.

The younger Van Hagen, Charles, is now secretary-treasurer of the Forest Products Research Society, and is living in Madison. He is a university graduate of the class of 1936. He has two daughters.

The Professor's daughter, Jean, is wife of Dr. John C. McCarter of Evanston, pathologist of the Evanston Hospital and member of the staff of the medical school of Northwestern University. She is also a University of Wisconsin graduate, class of 1930.

those pesky algae

(continued from page 11)

dota. Data gathered in this manner have shown that over ninety percent of the SiO_2 nd NO_3-N from the streams is retained in the lake. The logical conclusion is that biological utilization of these materials removes them from the water.

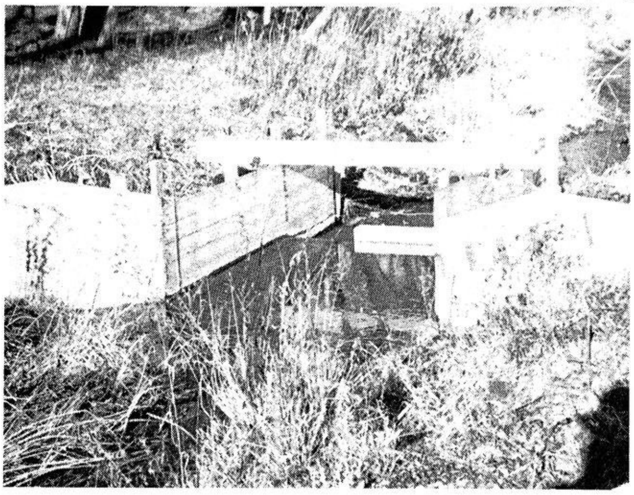
In addition to measuring and tracing nutrient materials entering the lake, the sanitary engineering department is studying methods of removing nutrients, particularly nitrogen and phosphorus from sewage effluents. This work is now being carried on under a grant from the National Institute of Health.

Other Researches

The botany department is conducting a program of study of the cultivation and physiology of blue-green algae. At present twenty-one species of eleven different genera are being grown separately in artificial culture media. Next year emphasis will be shifted to details of the physiology of these specimens. Investigation will be made of the factors of their inorganic and organic nutrition, stimulatory factors in growth, special growth requirements, metabolism, methods of large-scale culture, chemical control of growth, and the isolation of end products and toxins. It is recognized that the available quantity of soluble phosphorus and inorganic nitrogen largely determine the amount of algal growth, but restriction of growth by decreasing the supply of these elements is not feasible. These botanical studies may lead to the discovery of some critical factor, such as a vital trace element, which may be employed to control algal growth.

Ecological research into the phenomenon of the formation of algal blooms is also under way. This involves the study of climatic factors and the effects of currents and water movements. Although not definitely proven, there is an apparent correlation between wind conditions and the appearance of blooms. Blooms are more of a nuisance on the lee shore, and the rise of subsurface blooms has been known to occur in periods of calm after windy weather. Determinations of population trends of the

(Photo by Burgy)

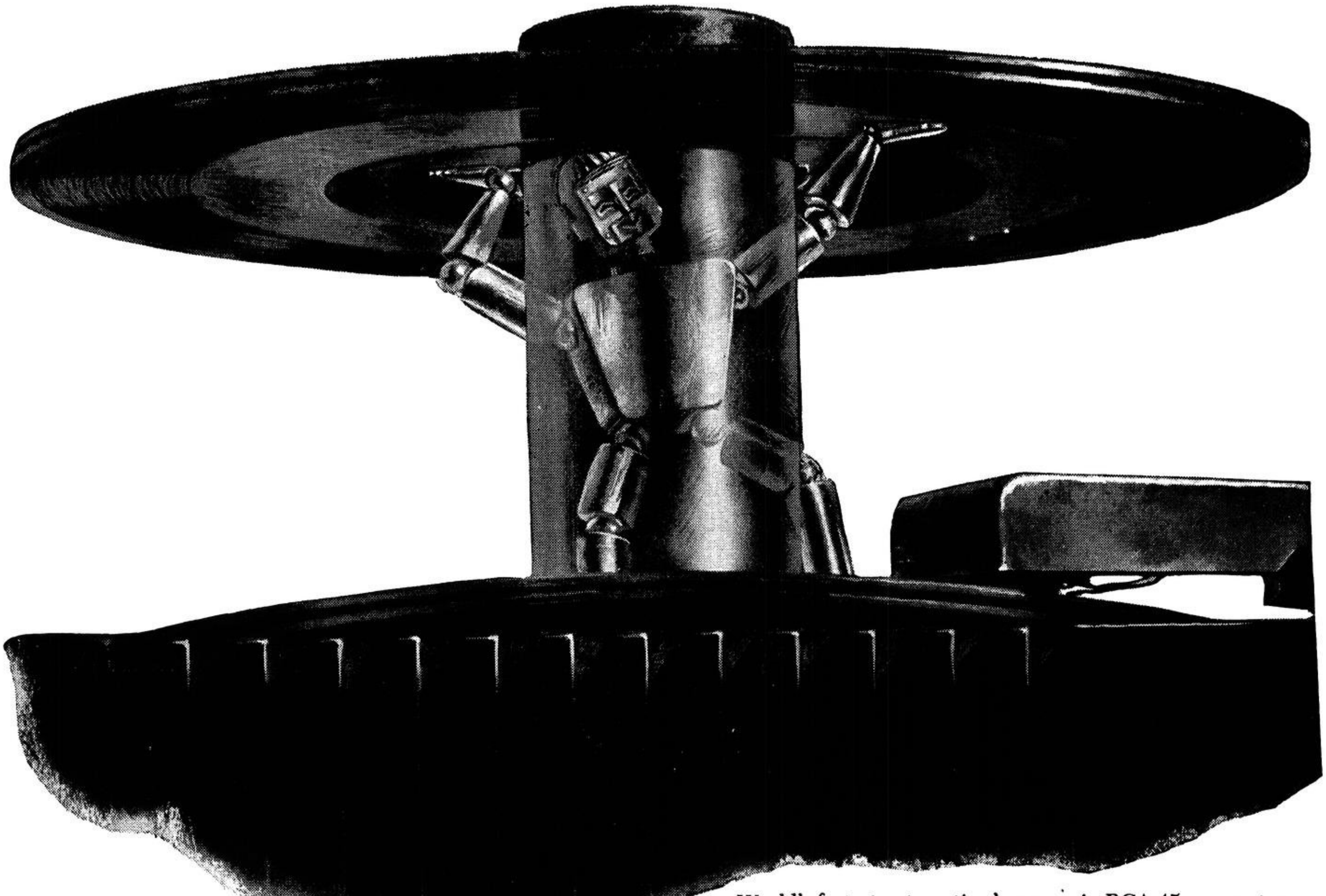


Two-step weir used in gaging flow of Pheasant Branch South.

various species are made during the different seasons. These data may then be correlated with the biological, physical, chemical, and meteorological factors.

Work is also being done by the mechanical engineering department on the development of machinery for the removal of weeds from the lake after cutting. The regular harvesting of crops of weeds will encourage weed growth and hence the removal from the water of nutrient materials which would otherwise support the growth of algae. At present the prototype of a machine designed for weed harvesting is being assembled. It will be similar to those used for harvesting kelp. It consists of a reciprocating mower and a mesh conveyor mounted on a barge driven and steered by side paddle wheels. This may prove to be a practicable means of checking algal growth.

Although the studies, as outlined above, have provided much useful information about the nature of the algae problem, it is evident that a satisfactory solution is still a long way off. But the development of an effective means of combating this nuisance will be a benefit to this community and to the rest of the nation as well.



World's fastest automatic changer—in RCA 45 rpm system—changes records in 5 seconds.

Quick change artist

Hundreds of thousands are now enjoying RCA's thrilling new way of playing records . . . they marvel at its wonderful tone . . . and the speed with which it changes records.

Prolonged research is behind this achievement, research which sought—for the first time in 70 years of phonograph history—a record and automatic player designed for each other.

Revolutionary is its record-changing principle, with mechanism *inside* the central spindle post on which records are so easily stacked. Result: a *simplified* machine, that automatically changes records in 5 seconds.

Remarkable, too, are the new records—only 6⅞ inches in diameter—yet giving the playing time of conventional 12-inch records. Unbreakable, these compact vinyl plastic discs use only the distortion-free "quality zone". . . for unbelievable beauty of tone.

Value of the *research* behind RCA's 45 rpm system—which was started 11 years ago at RCA Laboratories—is seen in the instant acceptance, by the public, of this better way of playing records. Music lovers may now have *both* the 45 rpm system, and the conventional "78."

* * *

Development of an entirely new record-playing principle is just one of hundreds of ways in which RCA research works for you. Leadership in science and engineering adds value beyond price *to any product of RCA, or RCA Victor.*

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
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- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RCA

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

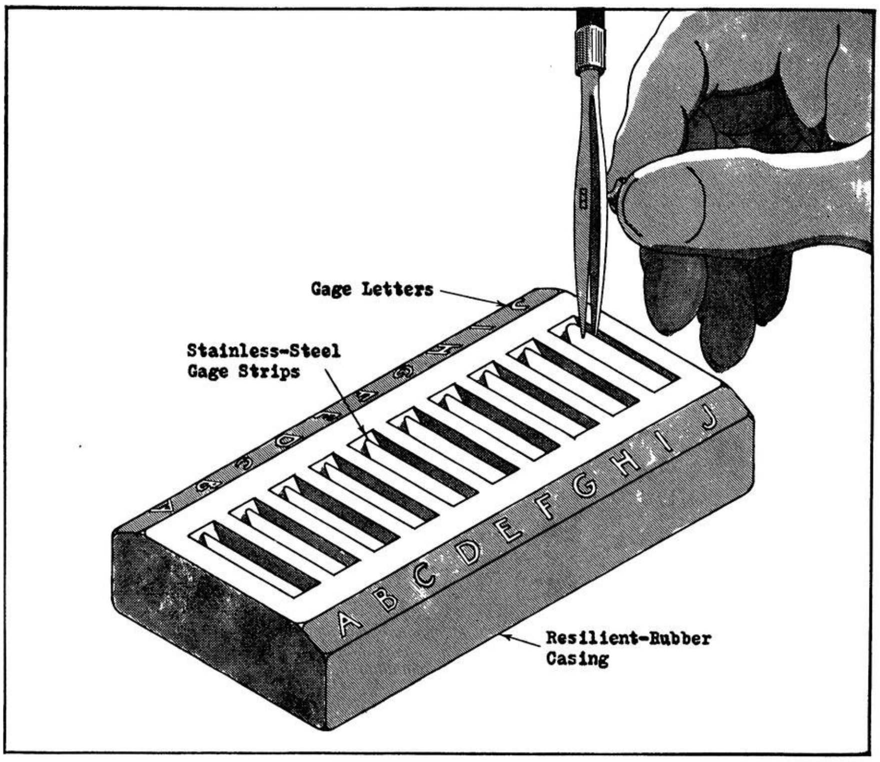
Science . . .

(*continued from page* 15)

passes through an atmosphere containing mercury vapor. The gases pass through a tube between an ultra-violet light source and an electric eye. If the gases contain mercury vapor, the light reaching the electric eye is less and the instrument records the change.

RULING PEN GAGE

Pictured below is a clever, useful device on which a patent is pending, called a Ruling Pen Gage. As soon as a suitable manufacturer is found, the gage will be distributed by United Industries of this city. Invented by Stanley Otis, an alumnus of the College of Engineering here at Wisconsin, it is designed to aid artists and draftsmen in maintaining uniform widths of inked lines.



(*Photo by Black*)

Ruling Pen Gage

It consists of ten stainless steel strips of varying widths corresponding to the different weights of lines required on industrial drawings. As can be seen from the picture, it is an extremely simple device. To regulate tip width, the draftsman merely lowers the open pen over a strip and closes the tips until they just touch the sides.

As any draftsman will admit, pens need constant cleaning and re-inking. This, in many cases, necessitates opening the blades, and thus losing the setting. To re-set the tips to the correct width, a number of trials is usually necessary, requiring ink, scratch paper, time, and temper. With this novel device, the draftsman merely sets his tips to the width of his choice, inks his pen and is ready to go.

The ten strips are mounted in a frame prior to being encased in rubber or plastic. Designed in this manner, rigidity is assured. In addition, the strips are recessed, so that no damage will result if the gage gets pushed off the table or is dropped.

EXPERIMENTAL WALL

Another example of the experimental work being carried on at the National Bureau of Standards is the experimental masonry wall faced with over 2000 specimens of stone from 47 states and 16 foreign countries. It will be used to study all phases of weathering on numerous varieties of stone as an aid in developing more reliable laboratory methods for predicting durability.

Progress and T-25

(continued from page 24)

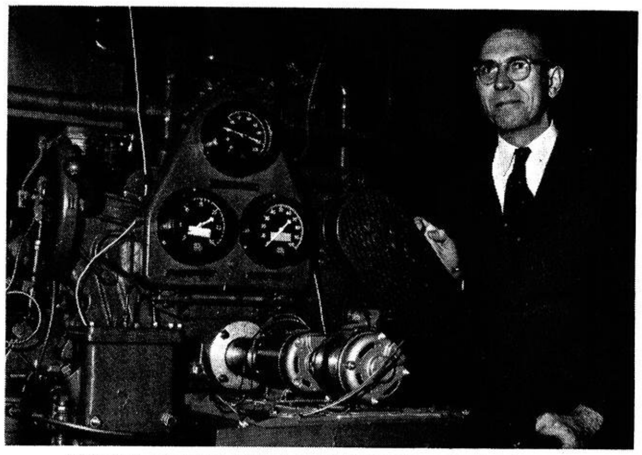
Where:

P = average power during an engine cycle.

p = instantaneous pressure.

T = time for one complete engine cycle.

v = piston velocity.



MEAN EFFECTIVE PRESSURE INDICATOR
J. D. Fleming

RATE OF HEAT TRANSFER

Because a proposed technical paper on the instrument has not, as yet, been published, further operational details cannot be given here.

Given the temperature at the surface of a combustion chamber wall, the rate of heat transfer from combustion gases to the wall may be determined.

The use of fine wires implanted a few hundredths of an inch below the wall surface as a base for temperature measurements has proved to be unsatisfactory; the thermal inertia of the wires has prevented accurate temperature measurements at high engine speeds. Thermocouples plated on the chamber walls remain to be tried.

Conclusion

Instrumentation at T-25 presents a very complete dynamic picture of what happens to the fuel B.T.U. Special instrumentation is being developed to determine the rate of Diesel fuel injection. The dynamometer and imep indicator present the power output facet of the picture, while the rate of heat transfer project will determine heat losses.

T-25 has been called the most complete internal combustion engine research laboratory in the nation. If past performance is an indication there is good reason to expect future progress in many fields from its personnel.

THIS IS HARRY WORKHOVEN *(arrow)*, at the time he retired from Standard Oil. His sons—a dentist and a radio announcer—are on either side of him. The others at the table are two Standard Oil employees and one retired employee.

A good place to stay is a good place to start

Mr. Workhoven worked 41 years for Standard Oil—a long time, but in this company, not an unusually long time. Each month, dozens among Standard Oil's 48,000 employees receive 20-, 30-, or 40-year service pins. The men and women who wear them have reason to know that Standard Oil is a good place to work.

Among the things that make it so is Standard Oil's employee benefit program, one of the finest and broadest in any industry. This program includes group hospital and surgical operation insurance, covering employees and members of their immediate families. It includes sickness and disability benefits, group life insurance and vacations. Our employee retirement plan sends monthly checks to retired Standard Oilers.

Peace of mind and pride of accomplishment are the common properties of Standard Oil employees. That is why so many of them stay with us through the years. Their long service is an endorsement of Standard Oil, for in this country an employee is free to choose his employer.

A company that is chosen by many people as a good place to stay is also a good place to start.

Standard Oil Company

(INDIANA)

STANDARD

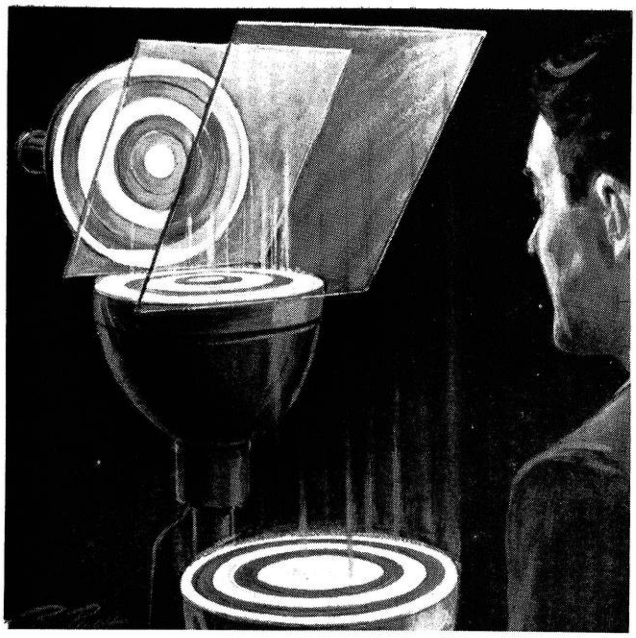
STANDARD SERVICE

Color T-V . . .

(continued from page 22)

ated or peaked due to the poor high frequency response of scanners, principally due to the long decay time of red phosphors. This peaking also accentuates the "noise" inherent in any pickup device. In the sampling process, this noise appears as low frequency components and causes a coarse-grain structure in the picture. For this reason, it was found satisfactory to sample only the video frequencies from zero to two megacycles. Those frequencies from two to four megacycles for each of the three primary colors are combined and called the mixed-highs. These frequencies carry the fine detail of the color picture and are fed into the transmitter along with the output of the sampler.

In the transition from the use of black-and-white television to color, it will be of importance just how compatible the two systems are. The RCA system described above enables color transmissions to be received as black-and-white on current monochrome sets without any modification. Actually, the 3.8 megacycle sampling frequency is superimposed upon the received signal causing a dot pattern on the screen but this is not noticeable at normal viewing distances. For the owner of a color receiver, this simultaneous system enables black-and-white transmissions to be received with full resolution on the color receiver picture reproducer.



Direct-view picture reproducing system of RCA's all-electronic completely compatible color television system in which three kinescopes are used with two dichroic mirrors to provide high-definition images in natural color.

WATCH FOR:

Patents
Dial Telephones
Professional Engineering Licenses
Robot Brain
Forest Products Laboratory
Retiring Professors

J. W. Watson
R. S. Owen

Freshman Awards
Job Opportunities
Typical Summer Jobs
Engineering Education in Hamburg

These are but a few of the articles
to appear in "YOUR" magazine.

The WISCONSIN ENGINEER

This is a picture of "PING"

It's a picture that gives automotive engineers clear-cut facts on performance—a picture that suggests how photography with its ability to record, its accuracy and its speed, can play important roles in all modern business and industry.

No, this is not the "doodling" of a man on the telephone. Far from it. It's the photographic record of an oscilloscope trace that shows, and times, detonation in a "knocking" engine. It all happens in a few hundred-thousandths of a second—yet photography gets it clearly and accurately as nothing else can.

Oscillograph recording is but one of countless functional uses of photography in bettering products and improving manufacturing methods. High speed "stills" can freeze fast action at just the crucial moment—and the design or operation of a part can be adjusted to best advantage.

And high speed movies can expand a second of action into several minutes so that fast motion can be slowed down for observation—and products be made more dependable, more durable.

Such uses of photography—and many more—can help you improve your product, your tools, your production methods. For every day, functional photography is proving a valuable and important adjunct in more and more modern enterprises.

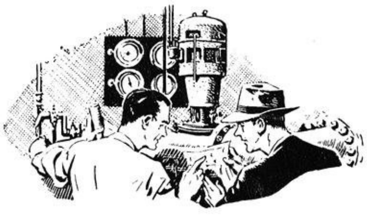
Eastman Kodak Company, Rochester 4, N. Y.

Functional Photography

. . . is advancing business and industrial technics

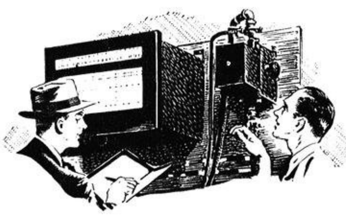
Kodak

TRADE-MARK



THE MAIN JOB *of one entire laboratory at General Electric is to keep guesswork out of G-E products.*

ITS STAFF *specializes in giving help on tough measurement problems.*



TYPICAL SOLUTION *was development of first "turbidimeter," advancing work on water-purification equipment.*

1000 Specialists tell us "When you can measure..."

Lord Kelvin, writing in 1883, summed up once and for all the importance of measurement.

"When you can measure what you are speaking about," he said, "and express it in numbers, you know something about it, but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind."

The need for detailed and accurate "numbers" is as great today as it ever was. Recently, for example, General Electric engineers working on water-purification equipment were hindered by the lack of any accurate way to measure water's turbidity. Another group needed data on the vibrations in their equipment.

But at General Electric any group up against tough measurement problems does not have to be stymied for long. It can "appeal" its case, can seek the aid of men who make a specialty of measurement and allied problems—the more than 1000 staff members of the G-E General Engineering and Consulting Laboratory. GE & C serves the entire company, and is also frequently called on by other industries and government agencies.

It solved the two problems above by developing the first "turbidimeter" and a "recording vibrometer" now finding applications throughout industry—two out of thousands of similar problems handled by the laboratory each year.

The work of GE & C illustrates again how General Electric backs up research and creative thinking, implements new projects with the best available facilities, and so remains in the forefront of scientific and engineering development.

You can put your confidence in—

GENERAL ELECTRIC