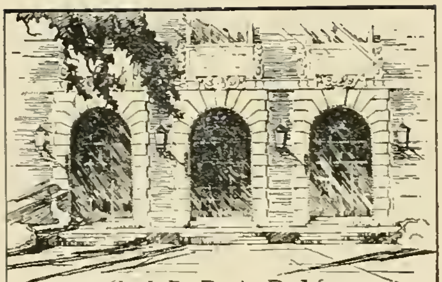
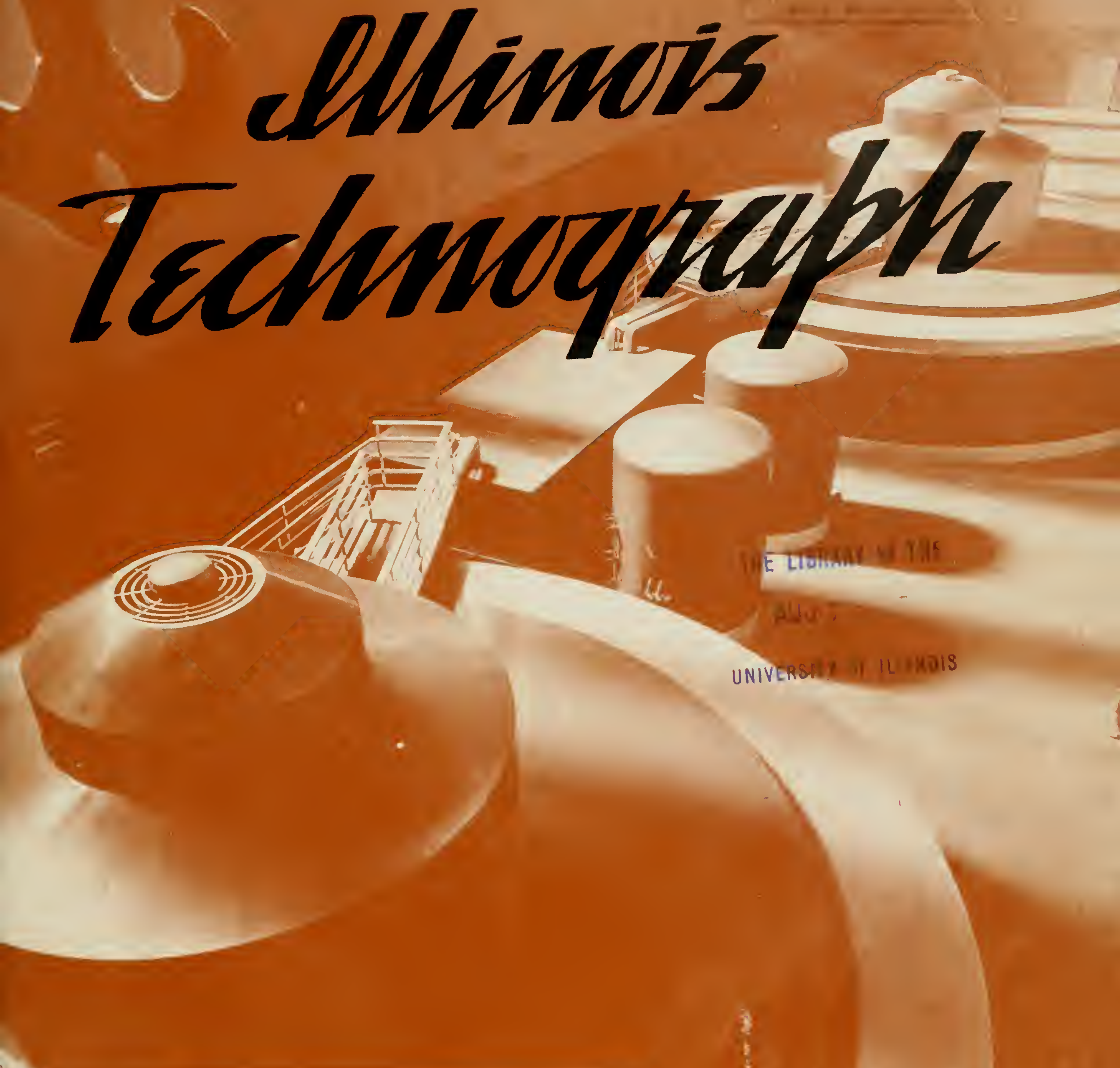


Illinois Technograph



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MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

October, 1944 20 Cents

Illinois Technograph

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The Tech Presents

☆ ☆ ☆ ☆ ☆ ☆

TECHREGRETS

Like so many other student activities, the TECHNOGRAPH has suffered losses due to the war. Our experienced personnel have been called to the service of our country, resulting in an unavoidable delay in the publication of our October issue.

Letter to the High Schools of Illinois . . .

For the first time, the "Technograph" is being sent to the high schools of Illinois through the cooperation of the staff and the College of Engineering. We are doing this in an effort to bring future Illini a glimpse of their University. Many of you in the reading audience will soon finish your high school training and will enroll in this and other universities. We hope that through the "Technograph" we may furnish you with a better insight of what waits in store for you.

As an introduction to new readers, we would like to explain that the "Technograph" is a monthly magazine written and managed by the students of the College of Engineering of the University of Illinois. We try to bring to our readers some knowledge of the courses offered here, the progress in research at the University, and many other educational aspects of college life. We also try to introduce you to leading members of the student body and faculty, the leading engineers of today, and the leading engineers of tomorrow. We report news of the various engineering societies and honoraries that are active here on campus, and endeavor to familiarize you future Illini with what lies in store for you at the University.

We believe that we are attending one of the finest engineering schools in the country, and the staff of the "Technograph" will make every effort in issues to come to substantiate that claim. We invite your interest and questions, and will be glad to furnish you with any information about the University and the College of Engineering that you desire.

We are looking forward to a long friendship and association.

THE EDITOR.

"TO THY HAPPY CHILDREN OF THE FUTURE,
THOSE OF THE PAST SEND GREETINGS"

This work by Lorado Taft, one of the foremost American sculptors and a graduate of the University of Illinois in 1879, occupies a position of honor overlooking the broad campus south of the Auditorium.

Quality Control Methods

By JOHN A. HENRY
Associate in Mechanical Engineering

For eight days, beginning November 29, 1944, the University of Illinois will be host to a group of men from industry taking a course entitled "Quality Control by Statistical Methods," sponsored by the United States Office of Education, the War Production Board, and the University Engineering Extension Service. Two members of the faculty and two representatives from the WPB will present the material, aided by talks from several men in industry who have put this amazing new technique to practical use in their own plants. What, may it be asked, is the magnet that has already drawn hundreds of men to similar courses throughout the country, and promises to fill the local quota with men from leading industries throughout the State and from other points in the Midwest? The purpose of this article is to discuss the general problem without going into a detailed explanation of specific procedures.

It is claimed that Quality Control by Statistical Methods will lead to:

1) Improvement of product quality
2) Labor and material economies
3) Decreased rejection and reworks
4) Decreased inspection costs
5) Improved producer-consumer relations

What is Quality?

Dictionary definitions merely entangle one in a series of similarly elusive words, but it is easy to explain how quality is actually created and maintained. First, a standard is established. Second, the product is made in more or less conformity with that standard, and finally, the product is examined to see whether or not it does conform with that standard. The casual student of civics will think of the three governmental branches of legislation, execution, and judicial review. The "narrow-minded" engineer, however, will immediately think in terms of design, production, and inspection. He will be quite right, for those functional groups, plus management, lie within the province of Quality Control. In the past, the major emphasis on quality has been thought of in terms of the inspection department. However, the slogan of Dr. Holbrook Working of WPB and his followers has become "You can't inspect quality into a product—you must build it in." Many progressive plants now have quality control organizations that are independent of, but work with, design, production, and inspection departments.

A statistical method is an efficient way of organizing related but unsystematic data into a usable conclusion. Quality Control by Statistical Methods makes use of a limited inspection data to uncover facts about the whole lot being sampled *as a basis for action.* It should be pointed out that this technique neither uses all the tricks of statistics nor solves all the problems of quality control.

Variation

It is important to realize that quality is a variable. It is axiomatic that neither man nor nature ever makes two things exactly alike. Statistical Control recognizes two kinds of variables, those which appear seemingly by chance, and those for which a cause may be assigned. It is these latter variables that should be eliminated. There are several statistical measures of variation, the two most important, for this discussion at least, being the central tendency as defined by such concepts as the arithmetic mean or average, the median, the mode and the geometric mean. Statistical control is concerned with the average, or the sum of n observations divided by n.

Mathematically, this reads, $X = (\sum^{n}_{1} x) / n$, where X is the average of the observations, X_1, X_2, X_1, ... X_n are the individual observations, and n is the number of observations.

Everyone knows the importance of the average, but many do not realize the dangers involved when it is used by itself. Take the case of the cross-eyed hunter and the patient deer. The hunter fired ten shots, five of which struck a tree ten feet to the left of the animal, and five more struck ten feet to its right. The hunter may argue that on the average he hit the deer every time, but he isn't kidding the deer. This brings us to a discussion of the dispersion, or the manner and degree in which the individual items differ from their central value.

The common unit of deviation is the Standard Deviation (Greek letter Sigma, σ). Sigma is defined as the square root of the average of the squares of the differences between the individual readings and their average. Mathematically, this reads: $\sigma = [\sum^{n}_{1} (x - x)^2 / n]^{\frac{1}{2}}$. There are shorter methods of calculating sigma which will not be discussed in this article.

It might be well to work out an example or two. In five successive attempts to cut cordwood, one workman (a) makes the pieces 46, 50, 47, 49, and 48 inches long, respectively. The method of determining the central tendency (average, X) and the dispersion (standard deviation, σ) is shown in Table I.

TABLE I.

Observation	Length Inches (X)	$(\bar{X} - X)$	$(\bar{X} - X)^2$
X_1	46	+2	4
X_2	50	−2	4
X_3	47	+1	1
X_4	49	−1	1
X_5	48	0	0
	$\sum X = 240$		$\sum = 10$
	$\bar{X} = 48$		

$$\sigma = (10 / 5)^{\frac{1}{2}} = 2^{\frac{1}{2}}.$$

The Normal Curve

In the theory of probability the so-called Normal Curve illustrated in Fig. 1 is of extreme importance. In many cases of natural and man-made variables the measurements of a large series of observations will group themselves as indicated, with the greatest number at the mid-point or average, and curving down and away toward infinity on either side.

This curve is widely used in the physical, biological, and social sciences. In fact, it is the mysterious curve against which students are frequently supposed to be graded, with C's at the mid-point and the A's and E's toward the extremes. However, it is usually recognized that the curve applies, strictly, only to infinitely large numbers of observations operating under chance causes. The mathematics must

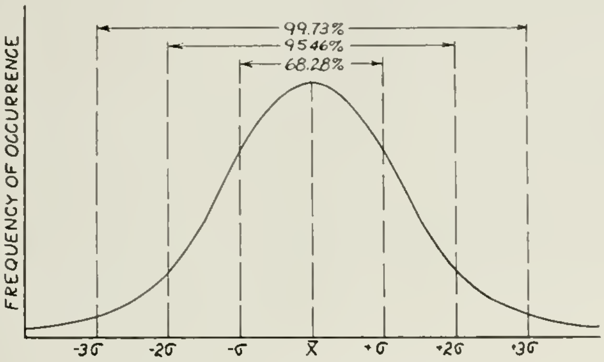


FIG. I THE NORMAL CURVE

be tempered with judgment when a small group of supposedly selected students is under consideration.

It is interesting to note that for a normal curve, the plus and minus one standard deviations come at the points of inflection of the curve. A central band 2σ wide includes 68.28% of the total area under the curve, one 4σ wide includes 95.46%, and one 6σ wide, 99.73%. It may be seen that $\pm 3\sigma$ contains nearly all the observations that will probably occur. An observation outside these limits is of such infrequent occurrence (three times in one thousand) that it will pay to assume it is due to an assignable cause, and look for it. In the case of manufactured product, it may be due to tool slippage or wear, faulty adjustment, different material, a new workman, or many other factors.

One might argue that the theory presupposes a "normal" distribution of product with no assurance that a given process actually so behaves. However, it can be shown that many processes do have a distribution nearly normal, and that the analysis is valid for near normal distributions with slight loss of efficiency. Furthermore, statistical study shows that the distribution of the averages of random samples of four or more pieces assumes a normal distribution, no matter what may have been the original distribution of the universe from which the drawings are made.

The Range

The standard deviation is an accurate measure of dispersion, but it is frequently difficult to calculate and the swiftly moving pace of production does not allow much time. As a consequence, investigations of the range have been made. The range, *R*, is the difference between the highest and the lowest values of a series of observations, and is easy to calculate. Investigations have shown a practical relationship between the standard deviation and the range for samples from a normal universe. By means of tabulated factors depending on sample size, the range may be used with a great saving of time.

The $\bar{X}$, R Control Chart

Figure II represents a control chart for averages ($\bar{X}$) and range (R). The operation was that of turning an outside diameter on steel bar stock. A sample of five consecutive pieces was taken every hour and $\bar{X}$ and R calculated and plotted. The three-sigma limits for both parts of the chart were based on the calculated average range, $\bar{R}$, for for the previous week's run and multiplying factors taken from standardized tables. Notice that if either the average ($\bar{X}$) *or the deviation* (R) of the sample falls outside its respective three-sigma limits, action is indicated. Action means investigation and correction of any trouble discovered.

Control limits are not the same as the drawing limits, often called specifications or the tolerance. Figure II represents the ideal case in which the process average ($\bar{X}$) is centered in the tolerance, which is wider than the six-sigma control band. Example (1) in the figure shows that the trouble was discovered before the samples exceeded the allowable variation, thus saving the loss of scrapped material. It should be clear that if the process is such that the control limits are wider than the tolerance, either the process or

(Continued on Page 24)

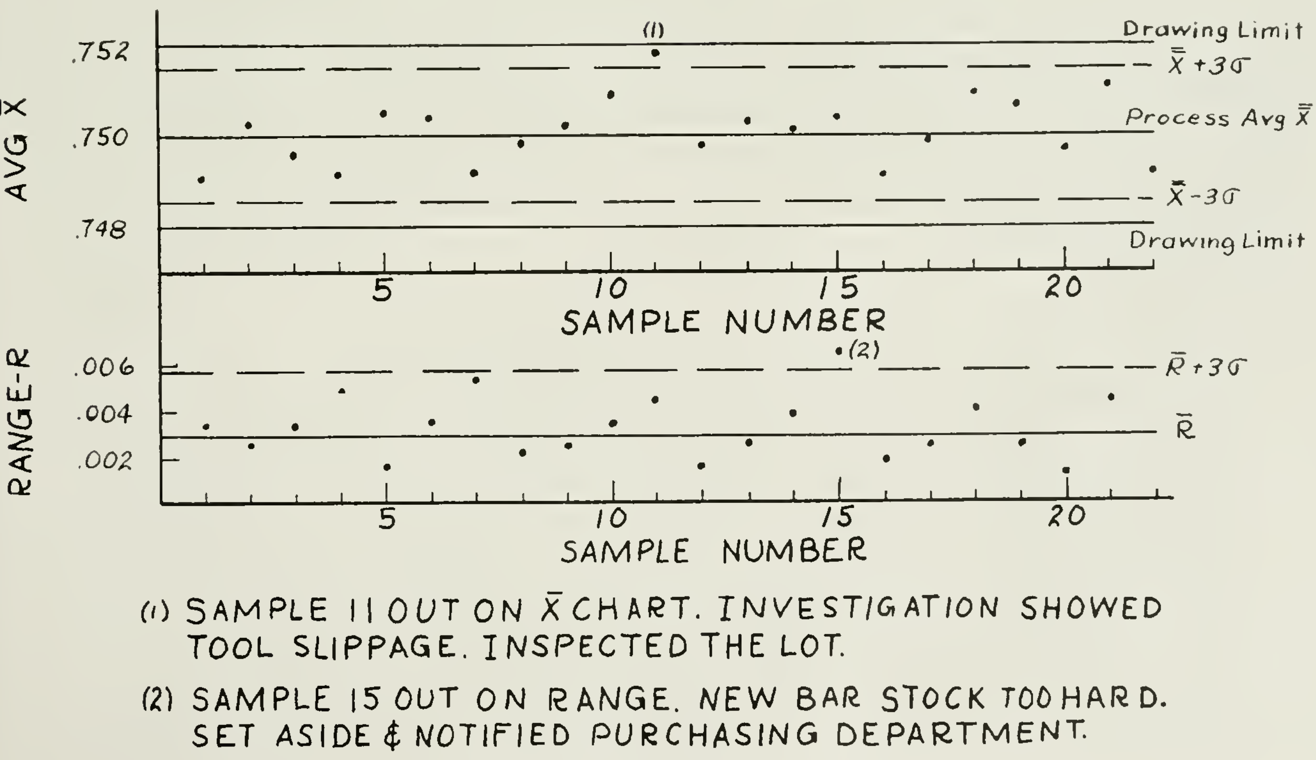
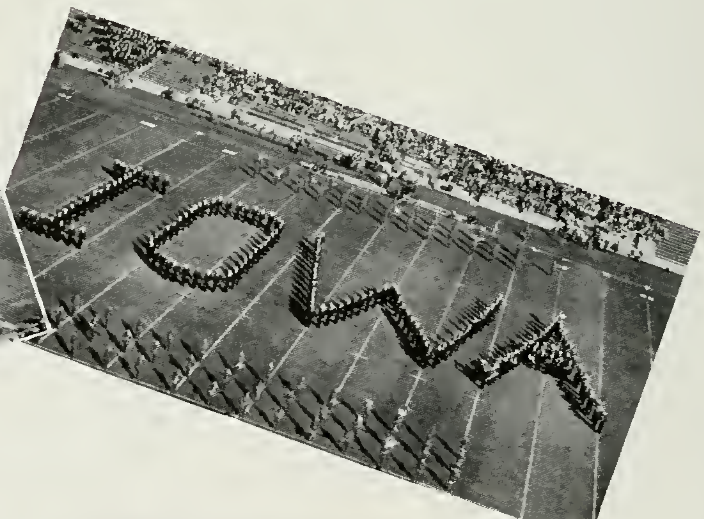
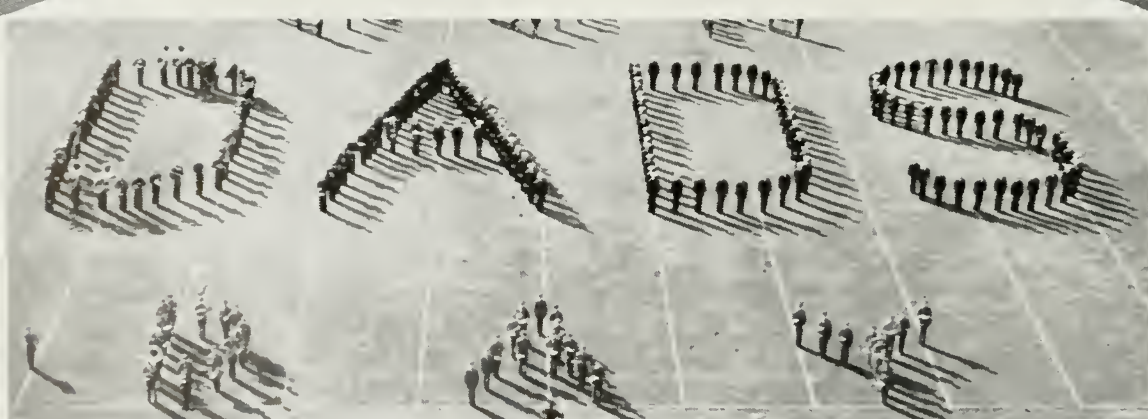
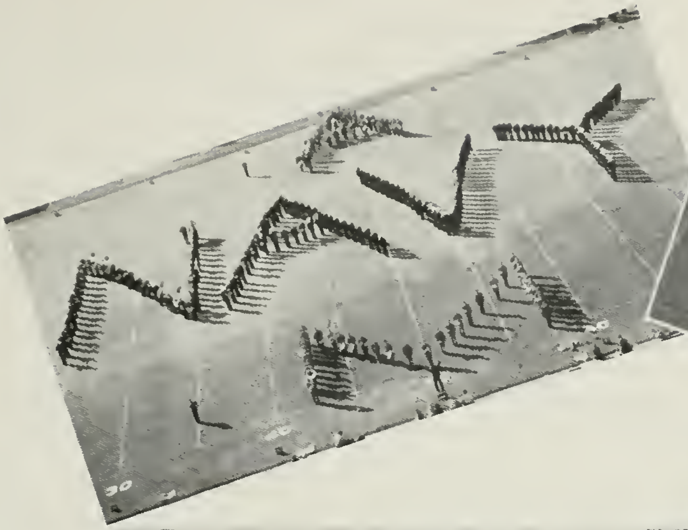
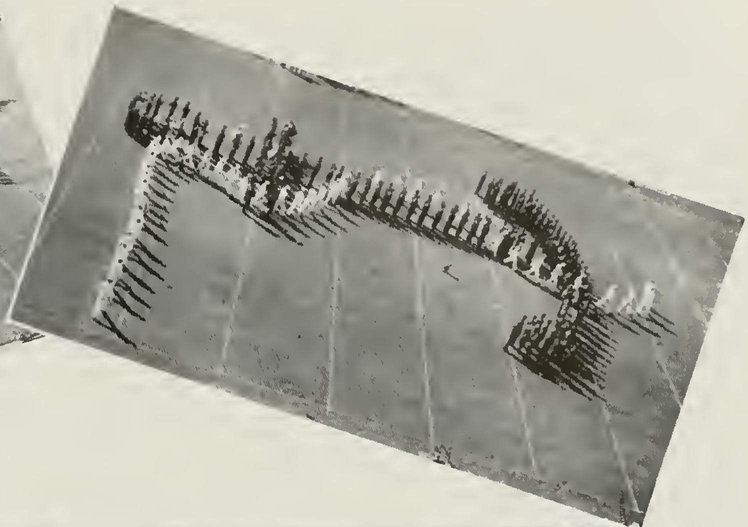


FIG. II AN $\bar{X}$, R CONTROL CURVE

Illini V-12 Engineers Enliven School Spirit






As a welcome change, the above V-12 engineers have dropped their slide rules, forgotten final examination worries, put aside unfinished reports to participate in the half-time ceremonies at Memorial Stadium. The marching unit composed of over 170 engineers has as its nucleus an excellent 60-piece band. In addition to making formations, the unit sings and plays appropriate college songs. All in all, the Navy engineers have certainly done a fine job in engineering that "Rah, Rah Spirit" at the games. No wonder the Fighting Illini are having such a successful season!

FIFTY YEARS AGO

By RALPH B. PECK and MEHMET E. UYANIK
C. E. Department

Fifty-three years ago, General William Sooy Smith, one of the outstanding foundation engineers of his day, addressed the engineering students of the University of Illinois. He discussed the problems associated with the construction of tall buildings in Chicago, the birthplace of the modern skyscraper. The speech, first published in the Technograph (1891-92), was quoted in the Chicago papers and in the leading technical journals, and it aroused widespread interest.

Foremost among the problems which General Sooy Smith considered was the settlement of the buildings, founded as they were above a layer of soft, compressible clay some fifty feet in thickness. Uppermost in his mind, without doubt, was his own personal disappointment in the settlement of the great Auditorium building, built five years before under his supervision as foundation engineer. Even during its construction, the settlement of the structure exceeded his expectations, and at the time of his speech, the maximum settlement had already reached eighteen inches.

The Auditorium was a combination theater, hotel, and office building. The accompanying illustration shows its massive character, and the austerity of style which made it an architectural milestone. In many respects it was a surprisingly modern structure. Its theater was acoustically perfect; it had a system of air-conditioning, and a stage which was raised and lowered by hydraulic elevators.

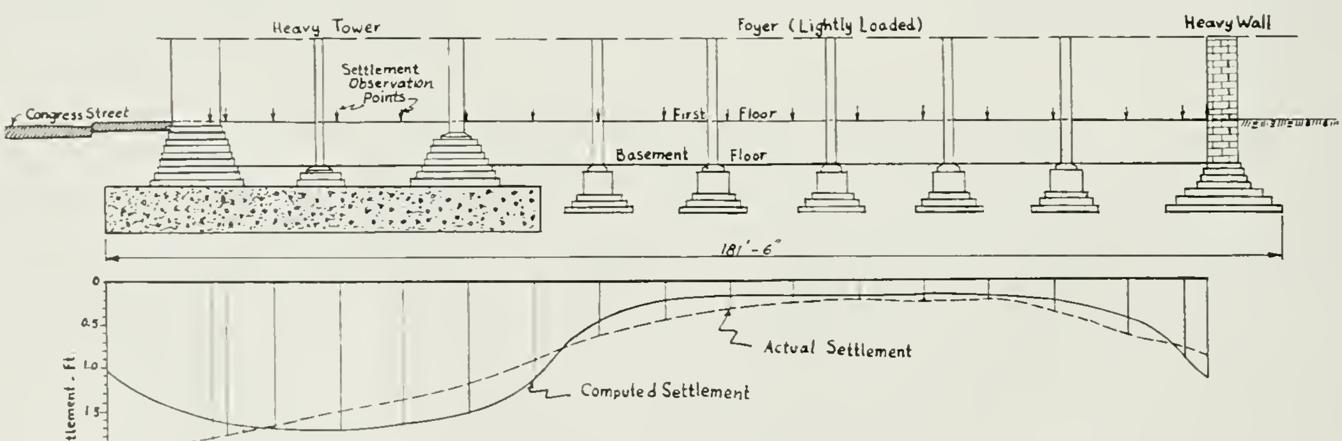
These elevators, in fact, were the means for giving General Sooy Smith the first clear conception of the cause of the settlement of a building on soft clay. The hydraulic pistons occupied cyclindrical shafts, about four feet in diameter, which extended to a distance of 24 feet below the bottom of the nearby footings. In the General's own words, quoted from the Technograph of fifty-two years ago, "The slow progressive settlements result from the squeezing out of the water from the earth—as was clearly seen while the wells were being sunk under the stage of the Auditorium. . . . I had made the borings and tests of the soil and knew the nature of the materials at different depths well. The clay, which was of the usual character when the borings were made, had all become compact and hard, and contained very little water . . ."

This quotation contains what is probably the first statement that the settlement of a structure on clay is caused by the reduction in water content of the clay. Many Chicago engineers in subsequent decades found this conception helpful toward a general understanding of the settlement problems with which they had to deal.

However, the full importance of Sooy Smith's conception was not realized for many years. It was not until 1923, when Karl Terzaghi, then a young Austrian engineer working at Robert College in Constantinople, made the attempt to predict the amount of settlement on the basis of laboratory tests. By these he determined the reduction in volume of a sample of clay due to its loss in water content under the action of a given pressure.

The forecast of the settlement of a building, according to Terzaghi's procedure, involved two separate steps: computing the pressure produced in the clay layer by the weight of the building; and determining the compressibility of the clay. Both of these steps were complicated; the first required the application of equations of the theory of elasticity, and the second involved sampling in the field and testing in the laboratory. Therefore, settlement forecasts could be made only by experts, and only for jobs large enough to warrant a considerable expenditure.

Before foundation engineers in a given locality could make settlement forecasts in connection with their own jobs, the complicated procedures had to be replaced by simple ones. In this simplification, the University of Illinois has



SETTLEMENT OF AUDITORIUM

OLD CHICAGO AUDITORIUM
Now Used as Service Men's Center

had a large part through the work of Professor N. M. Newmark, who reduced the difficult and tedious pressure calculations to such a great extent that they can now be made by any high school boy in a shorter time than the trained elastician once needed.

Likewise, workers in the field of soil testing discovered that the compressibility of clay soils, which could only be investigated by time-consuming laboratory tests, seemed to be related in a general way to the water content of the clay—a quantity which could easily be determined. For Chicago clays, studies have led to a simple diagram from which any engineer, knowing the water content of a given clay, can determine its compressibility without any tests or computations.

These two important simplifications have made possible the rapid forecast of the settlement of Chicago buildings. However, as in any branch of science, the correctness of the procedure has to be tested by experiment. The settlement of full-sized buildings has to be predicted and measured, and the results of prediction and reality have to be compared. Yet, if research workers should have to wait until new buildings attain their full settlement, it would be many years before the methods could be checked. The growth of soil mechanics and foundation engineering would be intolerably slow.

Hence, in order to check the new methods, research workers in foundation engineering at the University of Illinois, in cooperation with Chicago engineers and technical societies, are turning once again to the buildings of General Sooy Smith's day. The old records are being rediscovered, the old foundatioin plans searched, and in many instances new settlement levels are being taken. The old structures have themselves become the full-scale experiments, and make it possible to speed the progress of soil mechanics by a generation.

Even the Auditorium, which taught General Sooy Smith several lessons, is still teaching the research worker. The level readings started at the time of construction are still being carried out after almost sixty years. In the accompanying figure is shown the position to which one originally horizontal section through the building had settled by 1913. The agreement between real and computed settlement is very close. Certainly, General Sooy Smith would have given much to have been able to make and to have known that he should alter the foundation design. Although the General did not have the methods for doing so in his lifetime, he might well be pleased to know that the history of his structure has helped engineers of a later day to solve similar problems.

Thus, after half a century, the full fruits of General Sooy Smith's talk at the University of Illinois are being harvested by research at the same institution, and the average engineer of today can face and solve problems which baffled the greatest engineers of fifty years ago.

PROMINENT *engineer*

By HERB NEWMARK
C.E. '45

In a moderate, unpretentious office, I interviewed "Buck" Knight. It was a comfortable office, practical but also relaxing. On one side of the room were two comfortable rocking chairs, that looked as if they might squeak. "Buck's" desk was not large, and was not too cluttered up, although it wasn't an example of excessively meticulous housecleaning. On a nearby table sat a coffee-maker with two cups and saucers. Professor Knight explained that he always had coffee in the middle of the morning with whomever might happen to be in the office. In his bookcase was an interesting assortment of books, both technical and otherwise. I noted poetry, humor, and detective magazines, in addition to textbooks and handbooks.

PROF. A. R. KNIGHT

In fact, as I happened to walk into his office he was sneaking a look at a recent "thriller," something about murder. He was puffing on an elegant corncob pipe, which he explained was genuine and was just then given to him by an admirer, the five-year-old daughter of a fellow professor.

This man is Professor Abner R. Knight, the acting head of the Electrical Engineering Department. It is strange for me to write about him and refer to him by his full title, because to thousands of students and friends he has always been "Buck" Knight. He is a tall, dapper man, slim and handsome. He owns a beautiful suntan and a head of neat, grey hair, a little of which has been lost in recent years. Contrary to the popular belief about professors, he is a very well dressed man, and is usually found in smart double-breasted suits or conservative sport clothes.

Although I visited him that day for no other purpose than to gather facts about his past, our conversation didn't stick to that topic very long. Of the real truth about him, he claimed that his wife was the only person who could tell me. However, there are a few things about his personal life (off-the-record material) that he couldn't keep secret.

"Buck" takes great pleasure in attending fish fries and picnics, and although I've never been to a fish fry, I suppose (from "Buck's" conversation) that one does more than eat fish. When he tells you about such things, his face lights up with a big smile, and his eyes sparkle and gleam. In fact, one of the first things you notice about "Buck" is his smiling, happy eyes, which can help you laugh off any sad or serious situation.

"Buck" claims Columbus, Ohio, as his birthplace. His father, who still lives in Columbus is Professor William Abner Knight, former professor of industrial arts at Ohio State. "Buck" graduated from that university with a degree of Mechanical Engineer in Electrical Engineering, and since then has received the degrees of Master of Science and Electrical Engineer from the University of Illinois. After graduating from Ohio State, he served as chief electrician and construction inspector for the Springfield, Ohio, Light, Heat and Power Company. Before coming to Illinois as an instructor in 1913, he taught for two years at the University of Pennsylvania. At Illinois he has progressed until he is now a full professor and is the acting head of the Electrical Engineering Department.

He has two children, both educated at this University, a son, Lt. William Knight, USNR, and a daughter, Betty Ann. Pages could be written about "Buck's" social activities, which have earned him the honor of being chosen the "Man of the Month" by the News-Gazette several years ago.

In University activities, I believe that his record challenges that of any man in the country. "Buck" was a member of the Student Affairs Committee for one year and chairman for three years. He has been the University representative on the student senate for two years.

He was on the Illinois Union Board and has been on the Men's League Board and the Illini Union Board since the founding of each organization. He is on the Athletic Council and Board of Control of the Illini Publishing Company, serving as chairman of the latter organization. By the way, "Buck" really knows his Illini athletics, and can amaze you with detailed discussiions of games back in the twenties and thirties.

He claims membership in the following honorary and professional societies: Sigma Tau, Tau Beta Pi, Eta Kappa Nu, Sigma Xi, the Society for the Promotion of Engineering Education, and the American Association for the Advancement of Science. His social fraternity is Sigma Pi, and he is an honorary member of Triangle.

He is the co-author with Prof. G. H. Fett of the book "Introduction to Circuit Analysis" and he is a frequent contributor to many engineering and electrical magazines, in addition to being a popular speaker on technical and non-technical subjects.

Indeed here is a man who has combination of characteristics that are hard to beat. "Buck" has all the things that make him click with his students, his fellow scientists, and with all who meet him. Illinois is proud of "Buck" Knight.

Testing Mica Sheets

Our Societies . . .

By FRANK HOLECEK, M.E. '45, V-12

A. S. M. E.

Under the able leadership of Bob Fouts, Al Clark, John McGrath, and Charlie Rankine, as president, vice president, secretary, and treasurer, respectively, the student branch of the A. S. M. E. has concluded a very successful year.

Altogether twelve meetings, including talks by professors as well as informal discussions by others, were held. In a recent meeting, H. C. Rountree, head of the Engineering at the University of Illinois, discussed "The Future of Engineering Graduates in Industry." Perhaps one of the outstanding meetings of the year was the one in which Lt. Chester B. Clark, officer in charge of the Navy Signal School at the University of Illinois, discussed the duties of engineering officers at sea. Lt. Clark's twenty-nine years of experience in the U. S. Navy certainly has qualified him to speak on the subject.

All the members wish success to our advisor of the past year, Professor P. E. Mohn, who is leaving the staff to form a mechanical engineering department at the University of Buffalo.

Since the society will lose almost half its members at the close of the V-12 semester in November, there will be a membership meeting in the near future for all interested mechanical engineers. Watch the bulletin boards for an announcement of the date.

A. S. C. E.

During the summer term the A. S. C. E. made a continued drive for new memberships. The response was very good for twenty-eight new members were added to the roll. The meetings held during the summer were interesting and informative; both speakers and motion pictures were presented.

Early in the year we lost our president, Harold Eckoff, who was taken into the Navy. The other three officers, Paul Monohon, David Green, and Ralph Rohner carried on.

Recently, election of the new officers for the fall term was held. The results are as follows: David Tom, president; Tom Poyer, vice president; Bert Levey, secretary; and Robert Foecking, treasurer. Some interesting meetings are being planned for the increased number of engineers on the campus.

S. B. A. C. S.

Like many other organizations on campus, the Student Branch of the American Ceramic Society in the U. of I. Ceramic Engineering department has had its activities curtailed by war. However, under the able leadership of Jim Healy, Jim Griffiths, and Don Hamer, as president, vice president, and secretary-treasurer, respectively, the group has continued to function. Its membership at present includes all undergraduate members of the department.

The Society has as its purpose the promotion of fellowship and exchange of ideas among young ceramic engineers. Also, it provides a good connecting link between these young men and the older members of the profession. The University of Illinois chapter has been in existance since shortly after the establishment of the Department of Ceramic Engineering in 1913.

Monthly meetings include talks by ceramists of this area and discussion of topics of interest. A recent highlight was the picnic given by Dr. and Mrs. C. M. Andrews for members of the Student Branch and faculty at the Polliwogs, lakes near Danville, on August 12.

The Student Branch anticipates and welcomes new members from freshmen in the Department and will continue to increase its activities in the future.

SIGMA TAU

The Theta Chapter of Sigma Tau has been active on this campus ever since its founding in 1914. In the past year Sigma Tau has initiated well over thirty juniors and seniors, but has an active membership at the present time of only sixteen. There were seventeen more newly initiated members who joined the fraternity on October 15.

During the past summer some of the members of Sigma Tau held an informal get-together at one of the local cokeries. Sigma Tau, with the rest of the engineering honoraries is participating in the Formal Dinner-Dance to be held at the Urbana-Lincoln Hotel on October 21.

The present officers of the organization are Adrian Wells, president; Lowell Ackmann, vice president; Ray Skaggs, treasurer; and John Aschermann, secretary.

Those men who have just been recently initiated are as follows: La Verne Johnson, GE; John Harder, ME; George Didinger, EE; Dean DuBoff, CE; Walter Crum, CE; LeRoy Buzan, EE; James Reinschreiber, Chem. Eng.; Fred Leiderbach, Jr., ME; Charles Counts, Met. Eng.; John Giachetto, Chem. Eng.; Paul Monohon, CE; Richard Ball, ME; Louis Huebner, Arch. Eng.; Duane Watts, EE; Wendell Wilson, CE; William Jones, EE; and Burton Sorkin, CE.

CHI EPSILON

A very successful season for Chi Epsilon culminated in the initiation of Ronald Jack, Anthony Konstant, David McCullough, Boyd Paulson, Burton Sorkin, Albert Vander Werff, and Jean Schueneman.

At a recent smoker at the Y. M. C. A., Professors W. C. Huntington and T. C. Shedd addressed the members and rushees on "The Future of Civil Engineering."

Chi Epsilon joined with the other honorary fraternities on the campus in a formal dinner dance held at the Urbana-Lincoln Hotel October 21, 1944. William Frey, a member of Chi Epsilon and Tau Beta Pi, was chairman of the committee for arrangements.

A meeting will be held in the near future for election of new officers.

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VICTORY NEWS

Gas Turbines Take Up To 50% Less Space: Plans for a 5000 HP locomotive powered by 2 complete gas turbines have already been drawn up by Allis-Chalmers. Because of simple, compact construction, these turbines require just *half the space* needed by conventional engines—deliver their power with unusual economy.

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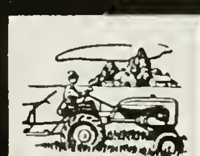


POWER FARMING MACHINERY

INDUSTRIAL TRACTORS & ROAD MACHINERY

PERSONALITIES . . . *on the campus*

By BERT J. LEVEY, C.E. '46, V-12

LOWELL EUGENE ACKMANN

Good-natured, friendly Lowell Ackmann has completed a college career at the University of Illinois that might be a goal for any aspiring engineer. All through his four years at this University, he has worked hard to maintain a superior scholastic record; but even though his engineering work did predominate, he always found time to keep up his social activities. Because of his clever wit and casual manner of leadership, Lowell has always been a favorite with the boys, and his smooth terpsichorean style

LOWELL

has kept him on the preferred lists of many sorority girls. It is this ability to correlate both engineering and social interests that has made the goal that Lowell attained even greater than that of an ordinary "bookworm" engineer.

Now don't think that because Lowell took time for extra activities he wasn't an outstanding student in his curriculum, for anyone that has attained a "little" over 4.5 as he graduates from the Electrical Engineering department must be pretty good.

Lowell's home has always been in Huntley, Illinois, just a small hamlet fifty miles northwest of Chicago. It was in Huntley High School that Lowell first started developing the initiative and ability to get along with other people which later helped him so much in college. He played basketball and football for three years while at high school, and won his monogram each year in both of the sports. Lowell also held several offices in his school's activity clubs.

In 1941, Lowell entered the University of Illinois as a General Engineer. He remained in this field for two years and then, upon entering the Navy V-12 program in 1943, transferred to the College of Electrical Engineering. In his freshman year, Lowell became a member of Sigma Phi Epsilon. It was probably through the eyes of his fraternity brothers that Lowell first got his glimpse at college life from other than an engineer's perspective. While still a sophomore, Lowell was made junior track manager and a member of Sachem. But upon becoming an upperclassman, his modest efforts rewarded him with membership in Eta Kappa Nu, honorary E. E. society, Sigma Tau, Tau Beta Pi, honorary engineering societies, and sealed all honors with his name on the Bronze Tablet. Lowell was vice president of Eta Kappa Nu and Sigma Tau.

Graduation and the receiving of his degree in Electrical Engineering on Sunday, October 1, sent Lowell on his way to a New York midshipman's school. And upon completion of a four-months' indoctrination course, Lowell will be commissioned an engineering officer in the Navy.

WENDELL "H" WILSON

Wendy "Glad to have you aboard" Wilson, senior C. E., is that congenial young fellow who can be found almost anytime in the design rooms of Engineering Hall.

Wendy, a member of the local Navy V-12 Unit comes from Decatur and Millikin University, where he was a member of Sigma Alpha Epsilon, social fraternity. If you should ask him why he came to Illinois the answer will invariably be "Because the Navy gave me the best break in my life—they made me a Civil Engineer."

Along the executive line Wendy is president of Chi Epsilon, honorary Civil Engineering fraternity, and Re-

WENDY

cording Secretary for Tau Beta Pi, all engineering scholastic fraternity. In addition to the above fraternities he holds membership in Sigma Tau, engineering honorary, and the student branch of the American Society of Civil Engineers. His scholastic average has been very high during his eight semesters of college, and this year his name was chosen to be among those to be placed on the Bronze Tablet of the University. Perhaps we can attribute his scholastic accomplishments to the fact that his social activities are confined strictly to the week-ends that a certain beautiful Pi Phi from Millikin University visits this campus.

As well as being gifted mentally, he also takes an active part in competitive sports. Many V-12s will remember him as the snappy, talkative catcher of the victorious B 3 team

(Continued on Page 24)

Personalities . . .

(Continued from Page 22)

in the intramural softball contest that was held this past summer. As captain of his team he did an able job.

With the completion of the present semester Wilson will take a "leave of absence" from the campus to continue his education in accordance with the plans of the Navy. However, he states that he shall be back in about a year to take up his graduate work. Certainly it is an optimistic attitude, but it is not a disheartening thought.

PAUL JOSEPH MONOHON

Few men can get through college without becoming snarled in the ties of promised matrimony—especially in these days of manpower shortage—but Paul Monohon, tall, dark, and handsome Civil Engineer, has made it. Tuyere, engineering social fraternity, and the University of Detroit have made a very significant contribution to our campus when, with the help of Navy V-12, Paul arrived to start his Junior year in July, 1943. Besides his remarkable record of never having missed a dance, party, or whatever occasion comes along giving an excuse for the companionship of the fairest of the fairer sex, P. J. is more than outstanding in his academic work. He is president of the Student Chapter of the American Society of Civil Engineers; treasurer of Chi Epsilon, honorary Civil Engineering fraternity; and a member of Tau Beta Pi and Sigma Tau, all-engineering honoraries.

Perhaps he became a Navy man because of his interest in sailing, his favorite pre-war pastime on Lake St. Clair in Detroit. But this is only one of a long list of hobbies which include stamp collecting, taxidermy, model boats and airplanes, and beautiful girls.

P. J., who is due to become an Ensign in the Sea Bees in a few more months, probably will spend a period of time in the South Pacific learning the principles of general civil engineering from a practical angle while dodging bullets from Jap snipers. However, he hopes to make it back as soon as possible to take graduate work.

FRED LIEDERBACH

Last July, Fred Liederbach saw the first of Illinois as he stepped off the train at Urbana to begin his career in the Navy. Fred, a 170 lb., 6 ft. 2 in. dark-haired lad hails from the East, up Philadelphia way. A hard worker in high school, Fred was honored with a four year scholarship to the University of Dayton where, aside from carrying on his good work, he was asked to join Alpha Lambda Tau, scholastic honorary. He also held the vice presidency of the university band, was a member of the Mechanical Engineers Society, and participated in a student Math Club.

As a V-12 student at the U. of I., Fred took such a great interest in his work that a respectable 4.75 all-university average is his spokesman. The old saying goes that if you want something done, have the busy man do it, is none the less true with Fred. While working on that 4.75 average, Fred took time out to become president of Pi Tau Sigma, M. E. honorary, treasurer of Tau Beta Pi, all engineering honorary, member of Sigma Tau and A. S. M. E. He also swam on the U. of I. swimming team, and played in both the University and Navy Bands.

As if all these activities weren't enough, Fred also found time for hobbies. Music takes first choice with him, followed closely by reading philosophical scriptures, tripping the light fantastic, photography, and flying light craft. True to Navy form, Fred has his heart set on one pretty lass from Chicago, Jeanne Connolly, with whom he has been making serious post-war plans for the last 14 months.

Speaking of post-war projects, Fred has already been offered a position with a large manufacturing concern to travel to South America on a power plant design project. If this prospect doesn't materialize, he would like to do production or personnel engineering work. But before we are carried away with this post-war dreaming, Fred reminds us that his war is just beginning. Nov. 6, of this year, he will report to Columbia Midshipman School where, after four months, he hopes to become an ensign in the U. S. N. R.

Speaking for all who have ever had the pleasure of knowing and working with Fred Liederbach, we wish to say that we are proud of his work, and wish him smooth sailing with God's speed.

Quality Control . . .

(Continued from Page 11)

the tolerance must be changed, for control limits show *what the process can do.*

There is also the P chart for fraction defective, or per cent of rejections. This can be used where go, no-go gages are in use, whereas the $\bar{X}$, R chart requires actual measurement of the pieces in the sample. It is simpler but not as effective as the $\bar{X}$, R chart of Figure 11. Quality Control by Statistical Methods also includes sampling inspection methods. It tells what size of sample will yield certain qualified information about the quality of a lot of goods, and how the respective risks of the buyer and seller may be determined. Its basis is the old standby of freshman algebra, the binomial expansion.

This may all sound formidable at first glance, but actually, Quality Control by Statistical Methods is in small part fairly simple statistics and largely a matter of engineering judgment in locating and correcting the causes of variation. The system was first called to the general attention of the engineering world in 1931 by Dr. W. A. Shewhart of the Bell Telephone Laboratories in his book "Economic Control of Quality of Manufactured Product." It has received its greatest growth in the past three years, and adoptions are being made at an ever increasing rate. Advertisements for the services of qualified experts in the field are appearing in technical journals, proof that it has "arrived."

It is hoped that there will soon be a course offered in Quality Control at the University of Illinois for engineers interested in production work. Meanwhile, it might be advisable for men interested in management, production, or scientific research to consider a course in statistics as an attractive elective.

PORTABLE FLASHING

A portable flashing beacon, using a gaseous-discharge lamp of a type originally developed for ultra high-speed photography, has been designed by General Electric Lighting division engineers for identification signalling at temporary Allied airports. It uses only one-third the power required for a stationary airport rotating beacon and weighs but one-third as much. Mounted on a collapsible mast, it produces a coded flash of such intense, split-second brilliance that its exact candlepower cannot be measured.

Power for this flashing beacon is supplied by a portable gas-engine generating set. The beam unit with its associated control fits into a small steel trunk with compartments for storing the beacon head, cable, lamps and tubes. A choice of five codes is possible simply by rotating a selector switch built into the control unit.

The flashes are obtained by charging the capacitor by means of the transformer and rectifier and discharging it through the lamp. A synchronous motor actuates the electronic relay to time the frequency of the flashes.

The beacon lamp is enclosed in a dome type lens which emits the light at all angles above horizontal.

The Scientific Japanese

Contrary to popular belief, the Japanese are "copyists." They are a "tough enemy" because the "Japanese ruling class has for years appreciated what scientific research can do to increase the strength of a country," declares Dr. Harold W. Bibber, chairman of the division of engineering at Union College.

The highly concentrated control of Japanese industry has facilitated support of scientific research in most industries. The central government has liberally financed research work in all important government departments. Educational institutions have struggled against tremendous odds in trying to educate Japanese scientists and conduct research work of their own. They have succeeded better than most Americans realize.

Commenting on the encouragement that scientific research in certain types of industry has had by the control of manufacturing in a very few hands, Dr. Bibber said:

"In Japan there may be many small plants of a certain industry scattered over the country, but they will all be controlled by only a few large holding companies. Thus, for example, the Mitsui and Mitsubishi holding companies have long controlled 70 per cent of all flour milling, and 80 per cent of all paper manufacturing in Japan. Each of these companies could afford, therefore, to set up very respectable research organizations in these fields. It has not been necessary in Japan as it has in this country to secure co-operative support of research in which 50, 100 or more companies each contributed to finance a research program for their industry."

According to Dr. Bibber, science in the form of chemistry, physics and biology was introduced into the Japanese schools in the 1870's. To get started immediately on science education, the Japanese government hired European and American scientists to come to Japan to teach in the newly set up universities and technical schools. The government sent hundreds of bright, young Japanese abroad to be educated, said Dr. Bibber, and many attended American colleges and universities during the 80's and 90's of the last century and even later.

"Such students seem to have been a fine group of men," he continued, "judging from those I met in different parts of Japan. By now most of them are very old or have passed on, and their moderating influence on Japanese public opinion has been lost."

Some achievements of scientific research in Japan with which Americans do not seem familiar are as follows: in the field of medicinal products, in some aspects of food chemistry—for example, Vitamin B was first discovered by a Japanese scientist; and in metallurgy, where, for instance, a sintering process for utilizing low-grade ore has been developed. It is likely that since 1939, important discoveries, if any, have been kept secret.

Outstanding Recognition . . .

Two members of the staff of the Department of Civil Engineering have recently received outstanding recognition by the American Society of Civil Engineers by being selected to receive the two highest awards to be made by that Society this year. The awards will be presented at the Annual Meeting of the Society in New York City next January.

The Norman Medal, which has been awarded to a paper by Dr. Ralph B. Peck, entitled "Earth Pressure Measurements in Open Cuts of the Chicago Subway," is awarded annually to the paper by a member of that society, which is judged "worthy of special commendation for its merit as a contribution to engineering science." It is the Society's highest award. The J. James R. Croes Medal, which has been awarded to a paper by Dr. Nathan M. Newmark, entitled "Numerical Procedure for Computing Deflections, Moments and Buckling Loads," is awarded to the paper "next in order of merit to the paper to which the Norman Medal is awarded."

The Norman Medal was instituted in 1872, and the Croes Medal in 1912. Since 1912, there have been sixty-one awards. Eighteen of these have been made to members of university staffs. Including the present awards, five have been received by members of the staff of the University of Illinois. Of these, three have been received by present members of the Civil Engineering Staff, one by a former member and one by a former member of the staff of the Department of Theoretical and Applied Mechanics. This record is not approached by any other educational institution. One other university has been associated with two awards; eleven others have had one each. The present double award in a single year is the first occasion in the history of the Society when two papers by members of the same organization have been selected in the same year. The award of the Norman Medal to Dr. Peck is the first in 56 years to a Junior member of the Society; only one other paper, in 1888, received the award under the authorship of a Junior.

In 1936, the Croes Medal was awarded to Professor Wilbur M. Wilson of the Civil Engineering Staff; in 1933, the Norman Medal was awarded to Professor Hardy Cross who was a member of the Civil Engineering Staff from 1921 to 1937; and in 1934, the Croes Medal was awarded to Professor H. M. Westergaard, who was a member of the staff of the Department of Theoretical and Applied Mechanics from 1914 to 1936.

Professor Peck received the degree of Civil Engineer from Rensselaer Polytechnic Institute in 1934. He was then awarded a fellowship for graduate study at that institution and received the degree of Doctor of Civil Engineering in 1937. He started the practice of civil engineering as structural detailer for the America Bridge Company, Ambridge, Pennsylvania. In 1938 he entered the Graduate School of Engineering, Harvard University, to study soil mechanics and served as a laboratory assistant to Professor Arthur Casagrande in connection with Franklin Falls Dam, and the foundations for the New England Life Insurance Building in Boston.

From 1939 to 1942, he was employed as Assistant Subway Engineer for the Department of Subways and Superhighways of the City of Chicago, in charge of the soil mechanics section. He was responsible for making soil investigations for structures in tunnels and open cuts for initial system of subways. The paper to which the medal was awarded was based on a part of this work. In 1942 he was Chief Engineer of Testing for Holabird and Root, Architect-Engineers for the Sciote Ordnance Plant at Marion, Ohio. This was one of the first construction projects awarded the Army-Navy E for excellence and speed of design and construction. Beginning in 1941, he lectured semi-monthly on soil mechanics at the University of Illinois and in 1942 he was appointed to his present position as Research Assistant Professor of Soil Mechanics.

During the war period he has been consultant on the foundations for new steel plants in Chicago and Cleveland involving construction costing about 150 million dollars; on the causes of and remedies for the bulkhead failure at the North Carolina Shipbuilding Company; on remedial measures for the landslide at Weirton Steel Company, Weirton, West Virginia; for Holabird and Root on foundations for the Statler Hotel, Washington, D. C.; for new structures at the Illinois Institute of Technology, Chicago; for Charles De Leuw and Company on Crib Wall construction at Winnetka, Illinois; on foundations for shops for the Rock Island Railroad at Silvis and Chicago, Illinois; to install uplift gages for shipways at Newport News, Virginia, for the Newport News Shipbuilding and Drydock Company; and on soil conditions for the Chicago Sanitary District.

Professor Newmark received the B.S. degree in Civil Engineering from Rutgers University in 1930, the M.S. degree in Civil Engineering from the University of Illinois in 1931, and the Ph.D. degree in 1934. He joined the staff of the University of Illinois in 1934 as a Research Assistant in Civil Engineering, and is now Research Professor.

His work at the University has included both analytical and experimental research on a large variety of projects including concrete walls, reinforced concrete highway bridges, foundations and aircraft structures. These have been conducted in cooperation with the Illinois Division of Highways, the U. S. Public Roads Administration, the Consolidated-Vultee Aircraft Corporation, and other agencies.

Professor Newmark has made many contributions to the engineering literature, including several Bulletins of the University of Illinois Engineering Experiment Station; and papers and discussions in the Transactions of the American Society of Civil Engineers, in the Journal of the American Concrete Institute, and in various other technical publications. He is a member of many committees of technical societies, including the American Society of Civil Engineers, the American Concrete Institute, and the Highway Research Board.

Professor Newmark has had important engagements as a consulting engineer for government agencies as well as Private industry. He has served as consultant to the Bureau of Yards and Docks of the U. S. Navy on the design of dry docks, to McCloskey and Company on the design of concrete ships for the U. S. Maritime Commission. He has also served as consultant to the Committee on Fortification Design of the National Research Council; to the National Defense Research Committee; and to the U. S. Gypsum Company of Chicago on problems arising from the failure of a large hydraulic press. At the present time, he is on leave of absence from the University to serve as a Technical Observer and Expert Consultant with the Office of Field Services with the Army in the Pacific Ocean Area.

AMERICAN PRODUCTION

turned tide of victory

The Japanese pilot who was shot down and captured while trying to escape from the planes of the mighty United States fleet that stretched across the sea shuddered at the sight. As far as he could see were carriers, cruisers, destroyers, and their auxiliaries. One look at this array, he told his captors, convinced him that Japan had already lost the war.

He was undoubtedly right. At that very moment, the fleet—Task Force 58, the most powerful and destructive naval unit in the history of sea warfare—was in the process of sinking Jap ships and destroying 757 Jap planes. But what he didn't know, and probably didn't think of, was how "58" was able to operate so many thousands of miles from its home base.

To wondering Americans the Navy Department later gave the answer: "Task Force 58," said the official release, "is able to carry its fuel, food, replacement aircraft and pilots wherever it goes. Operating as a tail-end group in the force, this 'train' has its own carrier protection, its own cruisers and destroyers for antiaircraft."

Here is significant information. And one word—"fuel"—is a story in itself. It is a story of the combined efforts of the Navy, the United States Maritime commission, the ship builders, the oil companies and General Electric.

In the wallowing '30's, when money was scarce and industry was doing its best to cut costs in order to sell more goods, an intense argument raged in the oil industry: Which type of ship was more economical to operate—a fast tanker or a slow one? There were many answers, but no decision was reached. Practically all of the 270-odd U. S. tankers then in existence were over 25 years old, obsolete and snail-slow; and the 70 new ones that were built after 1935 were, by and large, not much faster. Apparently, the proponents of slow ships had the field.

Then came the war.

The British were understandably silent about the number of tankers lost to Nazi submarines. But unofficial reports painted a dark and frightening picture. From 1939 to May, 1941, the Allies lost a million deadweight tons of tankers. Their fleet was dwindling—so rapidly that it was doubtful if they'd have enough oil to carry on the war.

Because of its peculiar neutral position, the United States couldn't offer much help. We were building a few tankers (some high-speed) under the Merchant Marine Act of 1936; but we still didn't have enough to supply the British as well as ourselves with oil.

Meanwhile, our chances of staying out of the war were daily growing slimmer. To meet the emergency looming in the distance, the Maritime commission, acting in cooperation with the armed forces, decided to start building the merchant fleet we should need if and when. Calling John Pew, president of Sun Shipbuilding, down to Washington, Rear Admiral Howard L. Vickery, commission vice chairman, gave him an order for 50 high-speed tankers.

Even for Sun, which was then the largest tanker builder, this was a staggering project replete with difficulties. But for one of the biggest problems—Pew had an immediate answer. He liked the performance of turbine-electric drive. Up to then, practically all the tankers built had been turbine-gear driven. But now turbine gears were needed for the great projected fleet of cargo vessels. In the whole country there simply weren't facilities to build this equipment for both the tankers and the freighters.

And so in Schenectady, and Lynn, and Pittsfield, and Philadelphia, and Erie, the men and machines that had been making apparatus for peacetime use turned rapidly to the production of turbine-electric drives for the first ships of the new U. S. tanker fleet. There was no delay.

The Maritime commission decision was made none too soon. Suddenly, out of the skies over Pearl Harbor came the Japs. We were in the war, and our tankers had become meat for Nazi subs. In the dark of night torpedoes thundered into the sides of our ships en route to England. Ships creeping up the Atlantic coast from the Gulf of Mexico were attacked, and flames and smoke filled the air. Oil from sunken ships soaked the beaches from Maine to Florida. Weary American seamen, burned and oil-coated, were brought ashore and laid up in hospitals to recover—if they could.

Our tanker fleet was being decimated. If we had needed to move fast in 1941, we now needed to move with the speed of light.

The Maritime Commission did. The 50 new tankers then building were not enough. Hundreds were needed. And so Admiral Vickery took up from where he had left off with Pew. After placing orders for more ships with the nation's shipbuilders, he called on General Electric to expand its turbine-electric-drive-building program. He did so knowing full well that he was thus killing two birds with one stone. He was not only getting most of the propulsion equipment required (not all, however: 102 Liberty ships were converted into tankers; 78 new tankers were equipped with turbine-gear and diesel drives), but he was also getting the propulsion equipment that would drive the tankers at such speed that they could avoid the deadly subs.

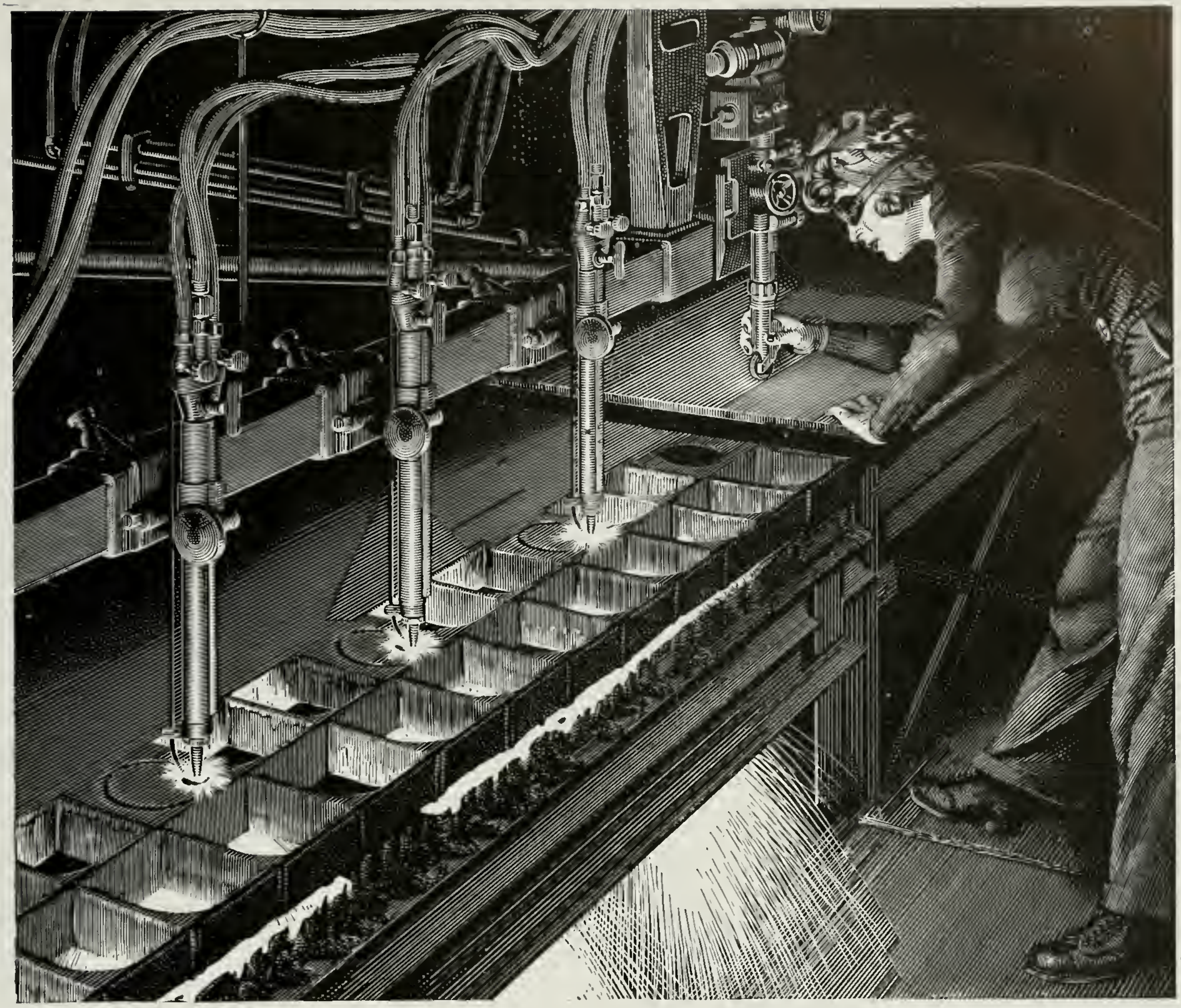
The size of the program undertaken by the large company is indicated by several facts: It is building three-quarters of the drives for the several hundred 6,000-horsepower tankers ordered by the Maritime commission. It has built all the drives for the forty 10,000-horsepower tankers ordered by the commission. And only recently has it filled half its total orders.

Dwarfing the railroad cars onto which they are loaded, the big equipments leave the General Electric factories on an average of three a week. They go to the shipyards at Chester, Mobile, Ala., Portland, Ore., and Sausalito, Calif., where they are installed in the holds of the ships. Champagne fizzes over the bows, the vessels slide down the ways—soon to join their sisters on the high seas.

Some are turned over to the Navy to serve as fleet oilers. Some are sold to private oil and tanker companies by the War Shipping Administration, which controls their movements. Most are operated by these same private companies under charter from the WSA.

In every case, their speed is serving the nation well. Official (but not top) speed of the 6,000-horsepower ships

(*Continued on Page 32*)



TURBOSUPERCHARGERS

With shipment of the 100,000th turbosupercharger produced, one of our nation's war plants has given Uncle Sam's fighting planes the means of recovering at high altitude more than 66 times the power generated at Boulder dam, or almost twice the output of the entire nation's steam power plants combined.

Aircraft engines, like crews, require oxygen at high altitudes, and a turbosupercharger recovers for a 1,200-horsepower engine the 920 horsepower it would otherwise lose at 34,000 feet altitude. Thus 100,000 turbosuperchargers recover 92 million horsepower in enabling American planes to function at maximum strength at high altitudes.

Without a supercharger, a 1,000-horsepower aircraft engine as built in 1941 would develop only 370 horsepower at 25,000 feet. But in 1944 engines rated at 1,200 horsepower and to be flown at 34,000 feet would deliver only 280 horsepower by themselves, so turbos to recover the lost 920 horsepower were developed for mass production. This was a new high in recovery.

Although called upon to recover more horsepower, Pearl Harbor turbos and those of today weigh substantially the same—135 pounds. Thus aircraft designers are spared their chronic headache—extra poundage.

The basic test for rating efficiency of energy is the amount of horsepower delivered per pound weight of the generating device. For the 1941 turbo, the weight per turbo-recovered horsepower was .214 pound; for today's model, .146, or a weight decrease (and therefore an efficiency increase) of one-third.

The Pearl Harbor model supercharger cost the government three times as much as today's improved unit. In terms of cost per recovered horsepower, today's turbo costs less than one-fifth as much as the 1941 model. The intensive effort of engineers and manufacturing experts in organizing large-scale production is saving Uncle Sam some seven million dollars weekly at the present production rate.

In 1941 a turbosupercharger required a major overhaul at the end of 300 hours; today's model requires only a minor overhaul after 1,300 hours, or more than four times the operating period. This improved endurance compares with engine overhaul requirements of 300 hours three years ago and 500 hours today.

One part of a turbosupercharger must stand redhot heat from the engine's exhaust gases while another is withstanding the sub-zero slip-stream at high altitudes. The 1944 turbo must operate at increasingly cold altitudes, yet spin at greater, and therefore heat-increasing, speeds. Metallurgists supplied the necessary new materials, notably a new alloy especially suitable for welding.

Ball bearing manufacturers developed bearings capable of withstanding the higher speeds, and an oil jet for lubricating them more efficiently than the previous splash system. To cope with the recent aluminum shortage without materially increasing the weight, the compressor casing was changed from cast aluminum to pressed steel.

Previously small "buckets" or blades of spinning wheels in the turbo were forged and machined. Now metal is poured into moulds, similar to those used in casting dental plates, and compressed under heat with a mass-production precision which eliminates machining. By flash-welding

(*Continued on Page 33*)

American Production . . .

(Continued from Page 28)

—designated T2-SE-A1—is 15.5 knots. The 10,000-horsepower ships—designated T2-SE-A2—travel one and three-quarters knots faster. Both types are of 16,600 deadweight tons, carry 135,000 barrels of oil.

Consider what this speed means. The pre-war tankers, running at about 10 knots, were easy prey for the submarines that can do 10 knots submerged, twice that on the surface. For these old ships, convoying was essential. But the T2's, equipped with anti-aircraft and deck guns fore and aft, can pretty well take care of themselves against subs alone. When carrying oil across the Pacific to the advance Army and Navy bases, or when operating between Texas and the Atlantic coast, they run free. Only when they are in trans-Atlantic service are they convoyed (often in especially fast convoys), because then they are up against a combination of Nazi subs and planes.

B. B. Jennings, director of tanker allocations for the WSA, says, "We've had comparatively little trouble from subs with the T2's. We lost a lot of old tankers because of their slowness, but the new ships get through."

That's what counts—the ship's ability to do their arduous jobs swiftly and efficiently—and it has had many happy results. For instance, operating over supply lines that stretch more than 56,000 miles to every continent and hundreds of islands, they are helping to supply the several million fighting men who are overseas.

Task Force 58 was able to steam thousands of miles into Jap waters and give battle, all because the fleet tankers could keep up with the swift warships and fuel them as needed.

Despite the fact that the old tankers still transport most of the oil needed in England, 50 per cent of the oil moved into the British Isles in the month of May was carried in new high-speed tankers (not all of them turbine-electric driven).

And finally, the tankers have done double duty as freighters. They are equipped with special lattice-like "Meccano" decks, on a level with the catwalks, on which great numbers of planes, trucks, PT boats, etc., are piled. Without this arrangement, the Army Air Forces could not possibly have handled their overseas shipments of airplanes.

How many of the tankers will survive the war cannot be predicted. Probably all but a handful. Some of them —the excess tonnage—will be sold to other governments. The rest will form the American tanker fleet—the largest on the high seas. Of these, the Navy will continue to use some to supply their off-shore bases and to serve the nation in time of future emergencies. A few may be laid up as standbys. But the majority will be sold to private oil and tanker companies as replacements for their old ships.

Obviously, the government and oil industry believe the turbine-electric tankers will be exceedingly useful after the war. How useful they will be can be gathered from the following facts cited by the experts of one major oil company:

1. The turbine-electric tankers have definitely proved more economical to operate than the old tankers. They may cost more originally. But on the other hand, they are more efficient; they can turn more knots; they can unload faster—all of which means that they can make more round trips between refineries and distribution points. They can, therefore, carry more oil per year; they can consequently deliver oil at lower cost.

2. The railroads, now doing such a tremendous job in carrying oil, will largely withdraw from the picture after the war because their high transportation costs cannot be borne by the consuming public.

3. So long as the government does not write off its enormous investment in the three pipe lines (one is privately owned) now serving the eastern seaboard, the new tankers can deliver a barrel of oil from Longview, Tex., to New York for about 3 cents less than the pipelines. And as the oil fields move from East to West Texas in the next 20 years, the cost differential will increase. It seems logical, therefore, for the tankers to carry most of the oil required on the Atlantic coast, the major consuming area.

4. To bolster the tankers' advantage, it should also be noted that the three pipelines together deliver less than half of the Atlantic coast's normal daily oil requirements. And the belief prevails that one of these lines—Little Inch —should be converted to natural gas.

5. The pipelines, however, will be the main supplies of the western half of the country.

6. United States' oil reserves are dwindling. Known (that is, explored) reserves are estimated at 20 billion barrels. At present rates of consumption, these would last only 16 years. It is imperative, therefore, that we conserve what we have. This means that, unless we are to curtail our driving and oil-heating drastically, we must import a good bit of our oil from Venezuela, Colombia and Mexico. For this we need big fast tankers and lots of them.

7. Just suppose that, for some now unforeseen reason, it becomes necessary for the United States to import oil, not from nearby South America, but from the distant Middle East and Far East. Then, more than ever before, we shall need these high-speed turbine-electric tankers, for they, and they alone, will be able to supply our demands.

To the layman, the postwar oil picture is confusing. One fact contradicts another; each experienced oil man has his own ideas. But if B. B. Howard, general manager of Standard Oil of New Jersey's marine department, is right in saying that "American tankers under private ownership and control are the most efficiently operated of any similar cargo carriers anywhere," then the war-built turbine-electrics will prove as useful postwar as now.

NAVAL GUNNERY

High precision methods developed at Louisville, Ky., in the nation's largest privately-operated Naval Ordnance plant have resulted in the manufacture of a 5-inch Naval gun so accurate it can hit a two-foot target at a mile and a 16-foot target at seven and one-half miles. The Louisville Naval Ordnance plant, started two years ago, already has produced enough of these guns to equip the equivalent of 375 average cruisers, and is the key assembly unit of three ordnance plants operated for the Navy.

This 5-inch single mount gun is one of the most accurate rapid-fire guns of this size in existence. It can fire as fast as it can be loaded, but the exact rate is a secret. It has an effective range of seven and one-half miles and can be used either as a combat gun or for antiaircraft fire.

In antiaircraft work, the gun's range frequently surprises enemy fliers who are accustomed to calculating their attack courses according to guns of far less range and accuracy.

Despite the highly-skilled nature of much of the work in the ordnance plant, representatives of 257 prewar professions, businesses and trades are now employed there. Included are former circus performers, several embalmers, a former professional hill-billy musician, and a pipe organ builder.

In addition to making the 3- and 5-inch guns, the Louisville Naval Ordnance plant manufactures slides—parts of the mounts—for 6, 8, 12 and 16-inch guns and has supplied to the Navy a large number of torpedo tubes.

Turbosupercharger . . .

(Continued from Page 30)

wheels to shafts and simplifying design of other parts to facilitate production-line welding, considerable time has been saved.

Long, tedious hand methods were circumvented by revamping milling technique so that many operations now require minutes rather than hours. Balancing, assembling and testing have undergone widespread changes in simplification of operations, permitting less skilled workers new to industry to participate on a large scale.

Perhaps the most spectacular battle application of turbosuperchargers is on the B-29. The basic function of this plane's eight turbos is to feed enough oxygen into the four 2,200-horsepower engines to take it to undisclosed heights above enemy flak. The turbos on two of the engines also pressurize cabin, enabling members of the crew to operate without oxygen masks, which they use only during bombing runs or in emergencies. The peace-time Boeing Stratoliner used separate cabin superchargers for this same purpose, but the B-29 is the first plane to use the engines' turbos for pressurization.—*Reprinted by courtesy of General Electric Company.*

Postwar . . . Air-Conditioning

One of the important and fast growing postwar industries is going to be single-room fractional horsepower air-conditioners or room coolers, even though only five or six years ago practically nobody knew what they were.

The fact that very few people understood what a room cooler was, what it did or how it functioned was probably the chief reason the entire industry sold only 30,000 to 40,000 of these units a year before the war.

But the performance, service and utility of single-room air-conditioners have been so outstanding and so apparent to the user, that word of mouth advertising within the past few years has done a remarkable educational job insofar as the general public is concerned. The news about air-conditioners has spread so rapidly that in the first postwar year, three times as many units will be made and sold as ever before, and it is not too radical a prophecy to say that three or four years after the war, annual volume should increase to six or eight times that of 1941. In that event the business might amount to $60,000,000 a year.

Before the war, only a few dealers realized the big profit possibilities of this merchandise, but within the last 16 to 18 months, we have been amazed at the number of unsolicited inquiries that have poured in from dealers. They seem to be coming to realize that here is a high-priced unit, selling from $175 to $400, which is easily and quickly sold for cash without high-pressure or expensive sales effort and without the need for any trade-in allowance.

When a dealer sells a unit for a home and installs it in the master bedroom, he quickly finds he has a customer for four or five units in other rooms. The same thing is true of installations in hospitals, hotels and offices. The single-room air-conditioner itself, by its performance, creates an amazing number of repeat sales and new prospects. Nothing else gives such relief to sufferers from asthma and hay fever, and use of air-conditioners is being prescribed with increasing frequency by physicians.

Undoubtedly the postwar units will be lighter in weight, and therefore, even more easily installed. They will incorporate the new materials and processes that have been developed by war research.

Gas Turbines . . .

The hot-air engine has been one of the favorite dreams of power engineers even before the days of the internal-combustion engine, but it was never realized because high compressor and engine efficiencies were not obtainable. What is now termed the gas turbine utilizes practically the same kind of a heat cycle as the hot-air engine. "Gas-turbine" is a misnomer. Those not familiar with this heat cycle sometimes think that it implies a turbine run with gaseous fuel, whereas it is a turbine operated with the products of combustion resulting from the burning of a liquid fuel. So far the gas turbine has not utilized a solid fuel because of the probability of serious erosion by the ash.

The first, broad, practical application of the gas turbine was the supercharger, but the function of ths supercharger was to supply an internal-combustion engine with air at a greater density than the surrounding atmosphere by utilizing the waste heat of the engine exhaust but without producing any additional mechanical power. A highly efficient compressor and turbine therefore were not so essential as in the case of the gas turbine where the energy produced by the turbine must supply the power required by the compressor and also produce net power for external utilization.

High efficiency for the gas-turbine cycle is greatly promoted by the use of higher temperatures, which means that metals should be available which can withstand such high temperatures.

The introduction of high-temperature steam and the mercury-steam heat cycle some twenty years ago were probably most instrumental in establishing high-temperature tests, in the form of creep and rupture tests, and in promoting the introduction of new compositions of metals for higher temperature. The supercharger, which employed temperatures in excess of the mercury and steam turbines, was also very largely instrumental in promoting the introduction of new compositions of metals.

The question arises as to whether or not the gas turbine may finally succeed the internal-combustion engine, as the steam turbine succeeded the steam reciprocating engine. At the present time, the internal combustion engine has a higher thermal efficiency than the gas engine. Whether or not the gas-turbine efficiency ever reaches the efficiency now attained by the engine will depend on the development of high-temperature metals and improvements in machine efficiencies.

Even though the gas-turbine efficiency may be poorer than that of the internal-combustion engine, it has promise in being smaller in size and lower in weight and generally will require no cooling water. When compared with the steam turbine, it appears to be not only smaller but a great deal simpler and does not require condensing water.

As science advances and engineering and manufacturing knowledge expands, the development of new prime movers is bound to be more rapid than in the past and the period of adolescence of the gas turbine may be much shorter than that of the steam turbine.

As the complexity of life increases, machines and processes become more and more involved. Many of these new schemes cannot be accomplished with small models or crude facilities, nor with little expense. Some of these developments can progress, from their conception only in a big comprehensive manner, and that requires a large organization of engineering and research talent and a company having diverse manufacturing facilities and skill. The gas-turbine development is one of these.

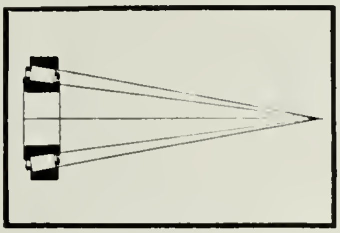
WHAT YOU SHOULD KNOW ABOUT THE TIMKEN BEARING

DESIGN

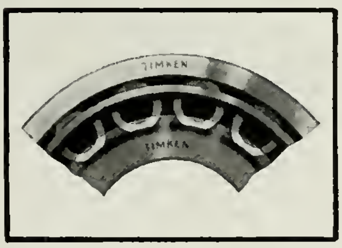
Essence of Performance

Timken introduced the tapered principle over 45 years ago to obtain an anti-friction bearing with the ability to carry radial loads, thrust loads or any combination of the two. During the ensuing long period of engineering development and experience, a constant refinement of design has taken place, making the Timken Bearing of today supreme in performance.

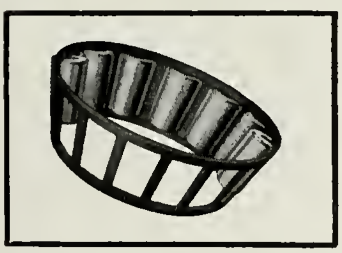
Here are the three most important features exemplified in the design of the Timken Bearing.



1. TRUE ROLLING MOTION: This basic necessity is assured by making all lines coincident with the tapered surfaces of the rollers, cup and cone, meet at a common apex on the axis of the bearing, Figure 1. True rolling motion always has been incorporated in the Timken Bearing.



2. POSITIVE ROLLER ALIGNMENT: During the development of the Timken Bearing, as speed, load and accuracy requirements increased, various methods were used to stabilize the rollers and prevent them skewing in the raceways. The solution was found in establishing wide-area contact between the large ends of the rollers and the undercut rib of the cone, thus assuring constant and accurate roller alignment around the periphery of the raceways. The light areas on the ends of the rollers in Figure 2, show contact of rollers with undercut rib of cone.



3. MULTIPLE PERFORATED CAGE: All the openings in the Timken Bearing cage, Figure 3, are stamped out in one operation by means of multiple perforating dies made to extremely close precision tolerances. This assures exact center-to-center spacing of the rollers around the periphery of the raceways, so that every roller takes its full share of the load when the bearing is in operation.

A thorough knowledge of Timken Bearing design and application will be one of your best assets when you graduate to enter the professional engineering field. Begin to acquire it now. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

TECHNOCRACKS

By MIKE MARTUS, M.E. '45, V-12

"And where is V-12 Watts?"
"A. W. O. L."
"What do you mean by that?"
"After women or liquor."

* * * *

Everybody likes to see a broad smile, especially if she smiles at him.

* * * *

A young kindergarten teacher sat down on the streetcar and smiled at the gentleman sitting next to her. He did not return her smile. Realizing her mistake, she said, "Oh, pardon me, but I thought you were the father of two of my children."

She left the streetcar at the next stop.

* * * *

Co-ed on cruiser: "I want to see the captain."
S2c: "He's forward."
Co-ed: "Oh, that's all right, I used to date Mary Witkin at the U. of I."

* * * *

Advice about women: If a woman looks young, she is old; if she looks old, she is young, and if she looks back, follow her.

* * * *

V-12 Gryb: "What's Professor Vaughn talking about?"
V-12 Stacey: "Integration, you half-wit."
Gryb: "Is he for it or against it?"

* * * *

Fehner: "Do you believe in free love?"
Co-ed: "Well I haven't sent you a bill, have I?"

* * * *

Professor Peters: "Now watch the blackboard while I run through it again."

* * * *

Mississippi: "Honey, would you mind if I kissed you all?"
Ackmann: "Ain't my lips enough?"

* * * *

A girl's a minor until she's eighteen. After that she's a gold digger.

* * * *

Frosh: "What do you do when a girl faints?"
R. Jack: "I stop kissing her."

* * * *

She was only the grave digger's daughter but you ought to see her lower the bier..

* * * *

Then there was the freshman who thought that a neckerchief was the president of a sorority.

* * * *

Lt. Bwake: "Why didn't you salute me yesterday?"
V-12 Tyszko: "I didn't see you."
Lt.: "Excellent. I thought you were mad at me."

Carlson's credo:

I am through with my mid-term tests
My papers were the best
I don't have brains, I don't have luck
But boy, oh boy, do I have suck!

* * * *

A pair of newlyweds had tipped the porter generously on boarding the train to keep the fact a secret. The next morning, noticing many knowing looks cast in their direction, the angry groom called the porter to account for his treachery.

"Lawdy, boss," he replied, "I didn't tell 'em. They asked me if you was jus' married and I sez 'no,' they is jus' good, very good friends."

* * * *

Hoffman: "I'm going to love you until the cows come home, darling."
Liz: "Okay, but never mind petting the calves in the meantime."

* * * *

Double E's lament: When I took my gal home, I tried to oscillate, and she almost had hysteresis, but I couldn't transform her. As I was walking home, a de-generate girl with brown coils threw ergs at me, so I called a copper to arrester. She said she had been dyne to do it ever since I rotor that letter. We didn't know it would a-vector that way.

* * * *

Two M. E.'s (who else?) were sitting on the fence watching a shapely lass saunter by. One who knew her socially prominent family said: "She's well reared."

"True," said the observer, "and she's not bad from the front either."

* * * *

"Bill, are you sure you are in love with me and not my clothes?"
Leutloff: "Just test me, darling."

* * * *

Larry Green: "Hi."
Gal:
L. G.: "Oh, well."

* * * *

Barbara (over telephone): "I'm sorry, Bert, but I'm all tied up."
Levey: "Say, that'll simplify things, I'll be right over."

* * * *

Didinger: "Since I met you I can't sleep, I can't eat, I can't drink."
Co-ed: "Why not?"
Did: "I'm broke."

* * * *

A drunk (Pete Kulick?) staggering along the street, bumps into a telephone pole, feels around it several times, then mutters, "S'no use. Walled in."

Storms that SAVE Lives

STORMS OF HAIL AND OF SAND . . . storms of rain and sleet, and fog. Temperatures of 60 degrees below zero Fahrenheit and 150 degrees above. Such combat conditions and low pressures of high altitudes can be produced in the weather chamber which you see here being used for testing Army Air Force equipment—equipment upon which the fighting effectiveness and the lives of men depend.

Stainless steel—large-scale production of which was made possible by the development of low-carbon ferrochromium by ELECTRO METALLURGICAL COMPANY, a Unit of UCC—lines the interior of the weather chamber. For *stainless steel* has the necessary resistance to the tortures that beset this all-weather "test-tube" room for research in materiel.

Tough, durable, rustproof, stainless steels are also used in surgical instruments, operating tables, and other hospital equipment. And, because they are easy to keep clean and resist food acids, they are widely used in equipment necessary to the preparation, processing, and serving of foods. "After-the-war abundance" will make it possible for all of us in thousands of places in industry and the home to enjoy the luxury as well as the utility of stainless steels.

Units of UCC do not make steel of any kind, but they do make available to steelmakers many alloys which give new properties to and improve the quality of steel. The basic research of these Units means new, useful metallurgical information—and better metals for the needs of men.

▼ ▼

Executives, architects, designers, teachers, and other professional men are invited to send for the booklet P-10 "Stainless Steels and their Uses." There is no obligation.

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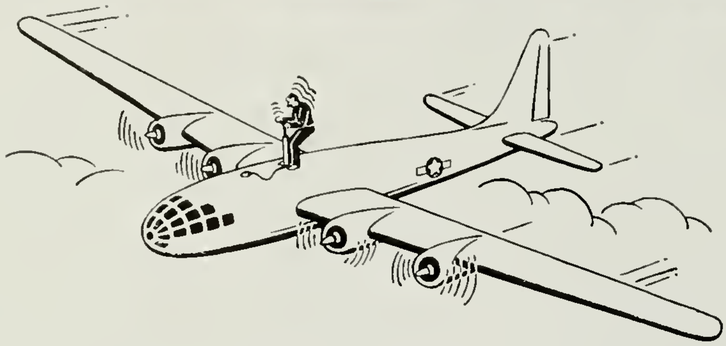
Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

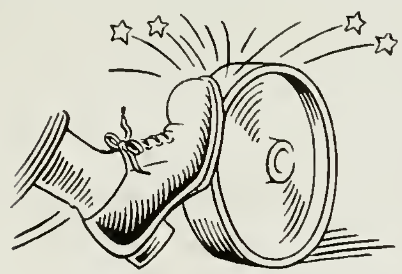


NEW PRESSURIZED CABINS

AN ALERT crew is needed to give any airplane the edge on the enemy. That's why the new B-29 Superfortresses have pressurized cabins that enable airmen to relax in relative comfort on unusually long flights between their base and the target.

G-E turbosuperchargers keep crew members warm and provide them with sufficient oxygen even at very high altitudes, eliminating the use of oxygen masks or electric flying suits except during the brief period of the actual bombing run. Consequently airmen feel better, react faster, when their objective is in sight and enemy opposition is the toughest.

The turbosuperchargers which maintain near normal atmospheric conditions in the cabin of the B-29 were originally developed by G.E. to provide compressed air for plane engines. On the B-29 there are two turbosuperchargers to supply each of the four engines. Two of the turbosuperchargers not only supply the engines, but also feed air at regulated temperatures to the sealed cabins.



FAST BRAKE

VERY often it's as important to stop a motor in a hurry as it is to get it going in the first place. One General Electric engineer has developed a brake that can stop a one-eighth-hp, 16,000-rpm motor in less than six turns. That's equivalent to stopping a mile-a-minute automobile in 2.73 feet.

Magnetism keeps the brake from the whirling rotor when the motor is running. When the power is turned off, a cork shoe brings the rotor to a standstill. The new brake has comparatively few parts. It was developed for use in the operation of equipment for the armed forces.

GROWING PLASTICS

SURROUNDED by foam, G.E. plastics laboratory men pronounce their newest product a huge success. A quart of molasses-like mixture which they have developed expands enough to fill a seven or eight gallon receptacle about ten minutes after it is prepared.

This foam has other advantages. Self-rising and self-curing, it is lighter than rock wool, glass, or cork; its heat conductivity is lower than that of any of the three. After the war it promises to have many applications, especially where insulation is required. *General Electric Company, Schenectady, N. Y.*

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

The best investment in the world is in this country's future. Keep all the Bonds You Buy.

GENERAL ELECTRIC

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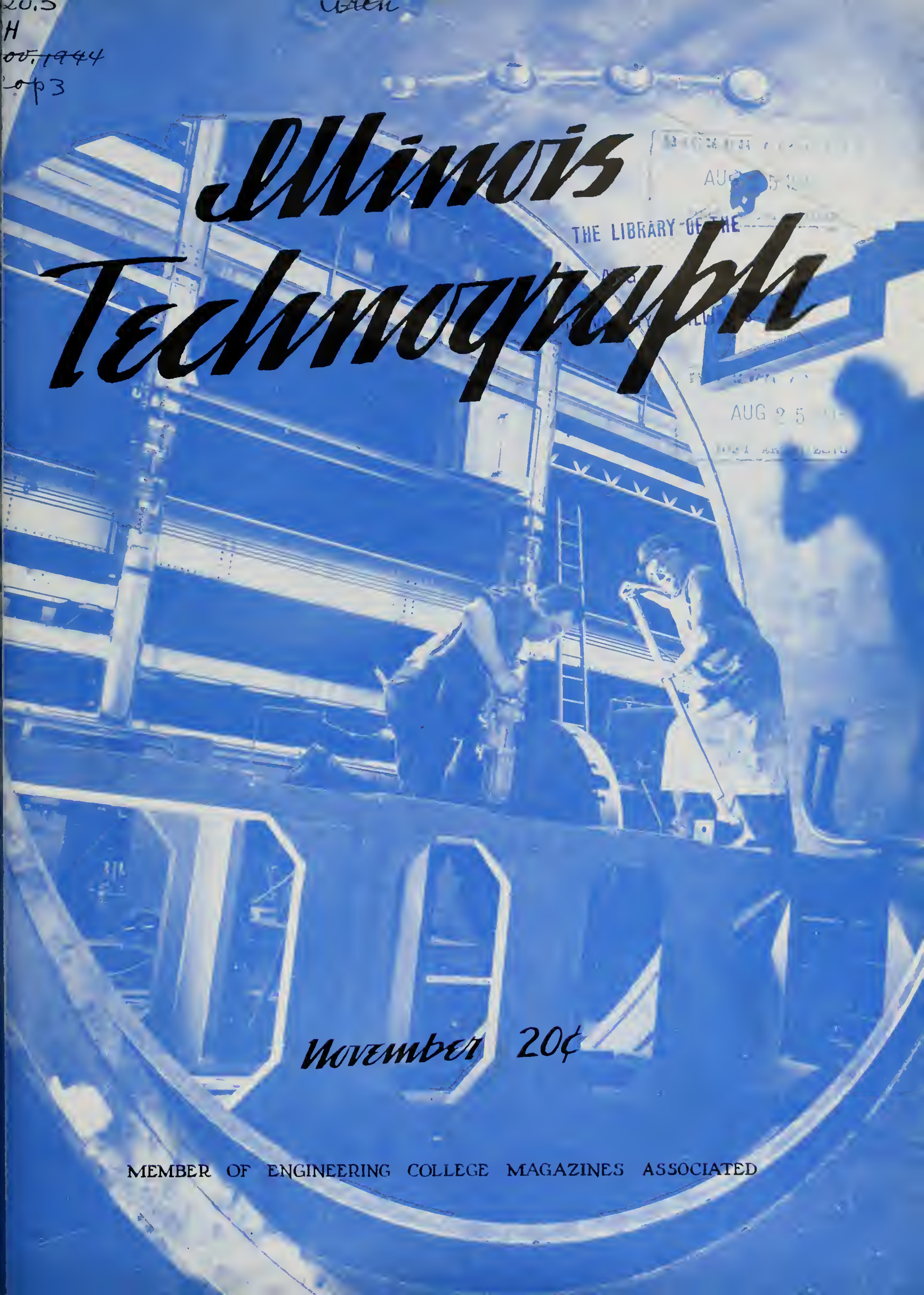

November 20¢

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Illinois Technograph

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The Tech Presents

COVER This picture might be a modern stage setting depicting man's conquest of machines. The workmen, casting their shadows on the bright steel frame, are assembling a bearing and gas-cooler section of the hydrogen tank enclosure for a 60,000 kilovolt ampere hydrogen-cooled synchronous condenser. *Photo courtesy Westinghouse Electric and Manufacturing Company.*

FRONTISPIECE An automobile hub in place in the induction heat treat machine, just after the hardening operation has been completed. The head of the machine has been lowered into the barrel of the hub, bringing the surface of the bore to a high temperature by means of electrical induction, and then withdrawn as water is forced at high pressure through a quenching fixture to complete the hardening operation. The whole operation is completed within a few seconds. *Photo courtesy Edward G. Budd Manufacturing Company.*

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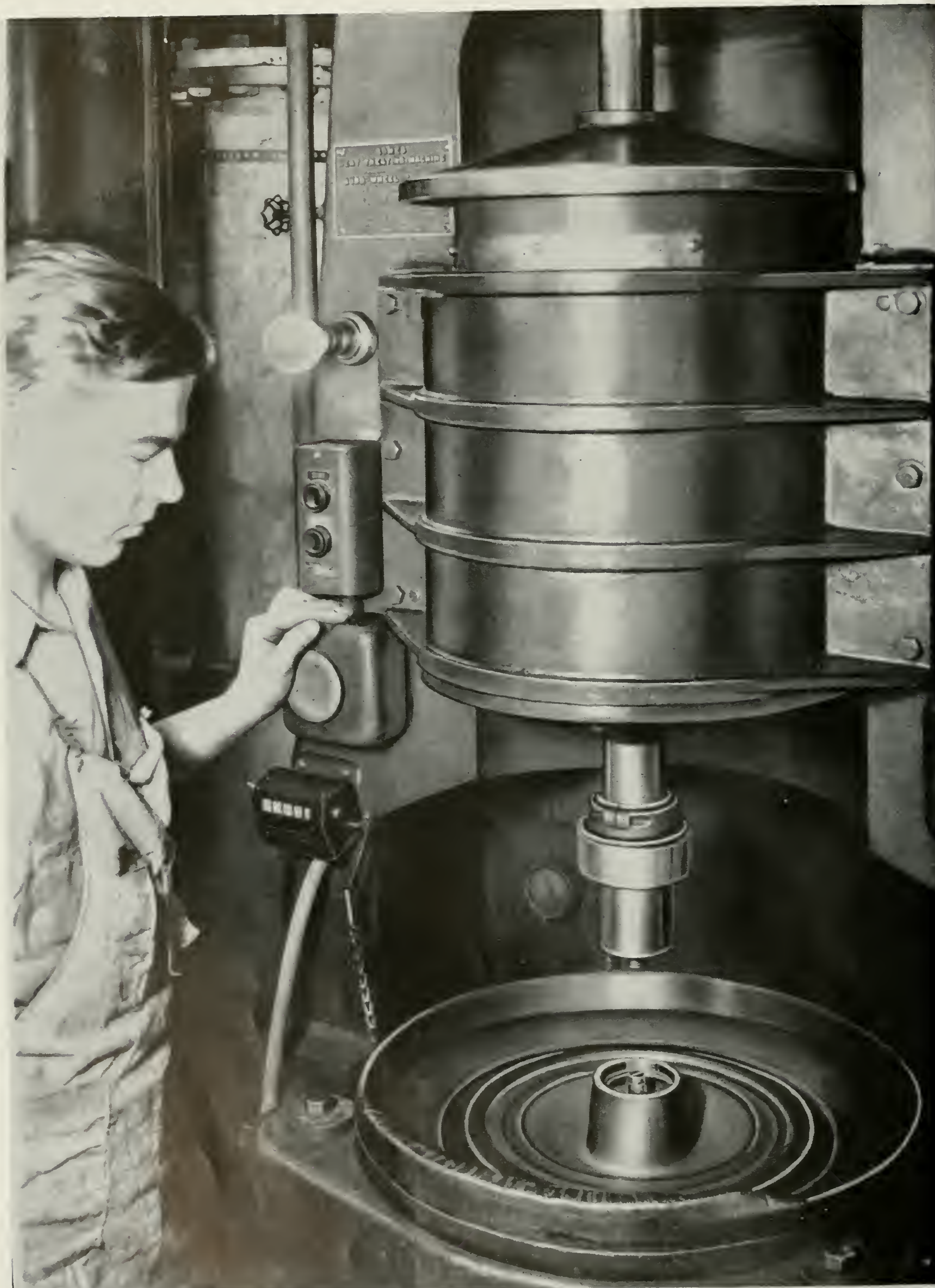
COMING NEXT ISSUE

Feature articles of the December issue will include a write-up of the new aeronautical engineering department, a description of the process of extracting magnesium from sea water, a discussion of engineering unions and state registration for engineers, and a discussion of post-war housing in the field of small homes, with a description of some of the work being done in this field here at the University of Illinois.



WHAT'S *with* METALLURGY?

By OTTO TURNOVSKY, Met. '45

The present world conflict has brought to light many new phases of science and industry: synthetics, plastics, sulfa-drugs, penicillin, high altitude flying and many others. Among these new sciences is one with a field and application all its own—the science of metallurgy.

Technically, metallurgy may be defined as the art and science of extracting metals economically from their ores and adapting them to human utilization. It is classed as an art because it still makes use of some unexplained phenomena and some rule of thumb methods and still finds necessary the use of skilled artisans who do work that cannot be learned from a textbook. It is classed as a science because it is highly developed in theory and in the study of the composition of metals and alloys and because the chemical processes for extracting and purifying metals have reached a scientifically exact perfection.

This, then, divides metallurgy into two separate phases: that of extracting the metal from the ore, or extractive metallurgy, and that of adapting it to human utilization, or adaptive metallurgy, sometimes called physical metallurgy.

Extractive metallurgy begins where mining stops; that is, after the ore has been mined and brought to the surface. From here the metallurgist takes over and releases the metal or metal-bearing mineral from the gangue which holds it captive. This is done by first coarse crushing it with jaw or gyratory crushers to break all pieces down to a given reduction so as to be of proper size for the next step, intermediate crushing. For this a jaw crusher, cone crusher, or set of rolls can be used. The ore is here crushed to a predetermined size, screened, and sent to the final grinding. Final or fine grinding can be done in either ball, pebble or rod mills. At this stage the particles are so fine that the grinding is worked with a pulp, water being added to the ground ore after the intermediate grinding operation. By means of closed circuit grinding in all of these steps, which embodies sending all particles too large back through the crusher and all too small ahead of it, less loss of valuable material is encountered.

The pulp is then thickened, filtered, and concentrated into a gangue and a concentrate so as to facilitate production and cut down expense of transportation. The concentrated ore is then smelted by any of the means available that seems to be most suitable for the particular metal or mineral. After reduction of the oxides and the sulfides and smelting, the slag (undesirable constituents that are floated to the top of the molten charge) is separated from the melt and the melt sent on its way to purification, while the slag is disposed of as seen fit or economical. Slag with a high phosphorous content is sold for fertilizer, while other slags are utilized for paving roads, making slag wool, or producing raw materials for the production of portland cement. The melt then goes on its way to the purification process, or processes, and is brought to the highest possible purity. From here, the adaptive or physical metallurgist is in charge.

The physical metallurgist utilizes the pure form of metal by fabricating it into useful utensils or by alloying it with other metals and then fabricating it. Some of the processes involved in the production of these materials are: rolling of sheet steel for fabrication of deep-drawn or pressed articles, drawing of wire for its many uses, and the casting of molten metals.

Too often prejudiced persons are apt to remark that metallurgy is too new and undeveloped a field, or too unimportant and useless to be of any value to industry. This may seem true to them, but it is probably because of a biased point of view gained from studying or working in another field intensively and not being able to correlate industry with any field but their own. On the contrary, metallurgy is quite a useful field.

Surely, the fact that a metallurgical engineering graduate with a B.S. degree is given $2100 per year as a wage

MICROGRAPH

to start with in industry at the present time in comparison to the $1700 he would have received in pre-war days, is some indication of a need for metallurgists. Other indications are the persistant advertisements in the newspapers as well as scientific journals calling for metallurgists, either experienced or inexperienced. Publications exclusively for metallurgists, increasing number of metallurgy departments and metallurgy schools throughout the country, a greater degree of precision in the production of alloys and rigid-specification materials, and closer tolerances in the fabrication of material, are all signs that this field has a definite place in industry.

Perhaps above all others, the chemist or chemical engineer, is the one that feels this supposed uselessness of the metallurgical field. The knowledge that he bears regarding chemical actions and reactions is far too insufficient to enable him to take the place of a metallurgist in a plant that utilizes the theory and application of adaptive metallurgy, without his first doing intensive study in the field.

The work that a metallurgist does involves a thorough knowledge of the effect of heat treatment upon the grain size, crystalline structure, and physical properties of metals; of time and temperature of heats; of effects of cold and hot working on metals; of charging of furnaces; of control of slags; and of other processes in which he has had specific instruction and training. True, anyone can, after any considerable experience in a metal fabrication plant, learn what is needed concerning the operation; but it is generally not the policy of a plant to hire an untrained and unskilled worker when a worker who knows both the process and the reasons for the steps in it can be hired.

Probably one of the most important accomplishments of a metallurgist is his ability to make diagnoses of the treatment a metal has received by examination of the microstructure under a microscope or from micrographs. With proper polishing and etching, a specimen can be made to reveal its heat treatment or its microdeformations due to external or internal stresses.

The process of microexamination begins with the choice of a specimen from the metal or alloy in question. This choice must be made with considerably rational decision as it must not only be representative of the average structure but it must embody the results of that particular defect or strain that is to be determined. When this is done, the specimen is taken to the polishing room where it is subjected to a series of abrasive polishes until it maintains a mirror-like surface free from any scratches or pit-holes.

To give some idea of the operation, here is a brief description of what takes place: the specimen, after having been ground to a flat surface on a belt grinder and washed free of grit, is taken to the No. ½ grit emery paper and rubbed in a direction so as to make the new scratches perpendicular to those of the grinder. After the surface has only new scratches and those of the grinder are all polished out, it is again washed free of any grit and takn to the No. 0 emery paper where it is again turned 90 degrees to the direction of the last polish and worked until only the new scratches are visible. It is again washed and the process is repeated through the No. 00 and No. 000 paper. It is washed and is then ready for the wet polishing wheels.

The polishing wheels are about 10 inches in diameter and are covered with various styles of cloths from canvas for a rough polish to velveteen for a fine finish polish. The steps here are the same as for the papers except that the abrasive is a mixture of water and a powdered abrasive material such as carborundum or aluminum oxide. The specimen is placed on the wet wheel and is rotated counter to the direction of rotation of the wheel. This is done to keep pit holes and casting holes from being drawn out to form tail-like structures. After the specimen has made the rounds of the wheels, it is taken to the microscope to see if it is free from scratches and pits. It may be interesting to note that scratches and pit-holes formed as a result of unskilled polishing will cause a polisher to return to the emery papers and start over four or five times before a satisfactory polish is obtained.

After polishing, the specimen is etched. Depending upon the etchant used, different features of the metal in the specimen may be obtained. Some examples of etchants are: 2% nital, 4% picral, nitric acid, and hydroflouric acid. Each etchant has its own properties with regard to etching; so careful choice of the proper one is necessary. Prior to etching, a specimen is washed with methyl alcohol and dried by the discharge of heated air from an electrical blower. The etchant is applied either by immersion or by swabbing with a piece of cotton. After the color on the surface of the specimen seems to be the right intensity and the grains of the metal may be seen clearly, it is washed with water, then with methyl alcohol and finally dried by the blower. The first etch is very often unsatisfactory; so a repetition of four or five etches may be necessary.

From etching the specimen goes to the microexamination, which is done under suitable magnification, dependent upon the constituents and structures sought. From the observations made, a conclusion is drawn regarding the condition of the material, and a remedy is prescribed regarding future treatment to eliminate any failures caused by the treatment given during previous operations. Another use for microexaminations is seen in the estimation of the constituents during a smelting operation. A test sample is taken from the furnace, allowed to cool, and examined for the approximate percentage of certain of the impurities, or alloying elements. From these results, corrections for the balance of the heat can be made. It is also useful in identifying the material of which the specimen is composed.

Pictured here are two senior metallurgical engineers. The one standing, Richard Dickson, is polishing a specimen

on a wet wheel that has been moistened with an abrasive mixture of water and aluminum oxide, Al_2O_3, while the one sitting, Roland Carreker, is viewing a specimen that has already been polishd and etched.

Occasionally, when there is a specimen that will be viewed at intermittent periods, or by more than one person, a photo-micrograph is taken of it with a metallograph, similar to the one shown. This piece of precision apparatus combines photographic as well as microscopic capacities. By this is meant that it acts as a microscope by enlarging the image of the specimen view from 25 diameters to 1000 diameters and that this image is projected upon a screen where a sensitive film may be placed and a photograph of the microconstituents taken.

After polishing, the specimen is placed face down over a small hole on the circular platform in the center of the machine. This platform can be raised and lowered to gain a coarse focus or moved forward, backward, or sidewise to facilitate finding a field which is satisfactory for a micrograph. Fine focusing is accomplished by use of dials attached to the objective lens which is immediately below the platform. The lens fixture is so constructed that a lens change may be made with ease and rapidity whenever a change of magnification is desired. The microscopic projection is carried through the objective lens and reflected from a prism through the ocular lens. After passing through the bellows, the image is brought to focus on the ground glass screen. Intense illumination is supplied by a carbon arc located in the sheet metal housing at the opposite end of the machine

(Continued on Page 14)

The Effects of Heating Rate

By K. J. TRIGGER
Assistant Professor in M.E.

During an investigation on the transverse strength and toughness of molybdenum-tungsten high speed steel, it became advisable to evaluate the effect of the heating rate in tempering. Tests were also conducted to determine the effectiveness of a double temper on the transverse strength of small test beams.

This investigation was carried out on high speed steel containing approximately 5½% tungsten, 5% molybdenum, 4% chromium, 1½% vanadium, and 0.8% carbon. Material was secured through the kindness of Columbia Tool Steel Company. Test samples were prepared from commercial ½-in. square stock cut into lengths of about 4½ inches. They were shaped equally on all sides to approximately 0.4-inch square, and surface ground to 0.385-in. square prior to heat treatment.

The heat treatment consisted of (a) preheat at 1100°F for 15 min., (b) preheat at 1500°F for 15 min., (c) high heat at 2230±5°F for 4 min., (d) quench in oil at 80°F until cold, and finally (e) temper as follows:

1. Place in an unheated electric furnace, heat to 1025°F in 1½ hr., and air cool. Repeat operation starting with a cold furnace, hold one hr. at 1025°F, and furnace cool.
2. Place in a hot electric furnace and heat to 1025°F in 10 min., hold 1 hr., and air cool. Repeat operation, hold 1 hr. at 1025°F, and furnace cool.
3. Single temper, starting with a cold furnace; heat to 1025°F in 1½ hr., hold 2 hr., and furnace cool.

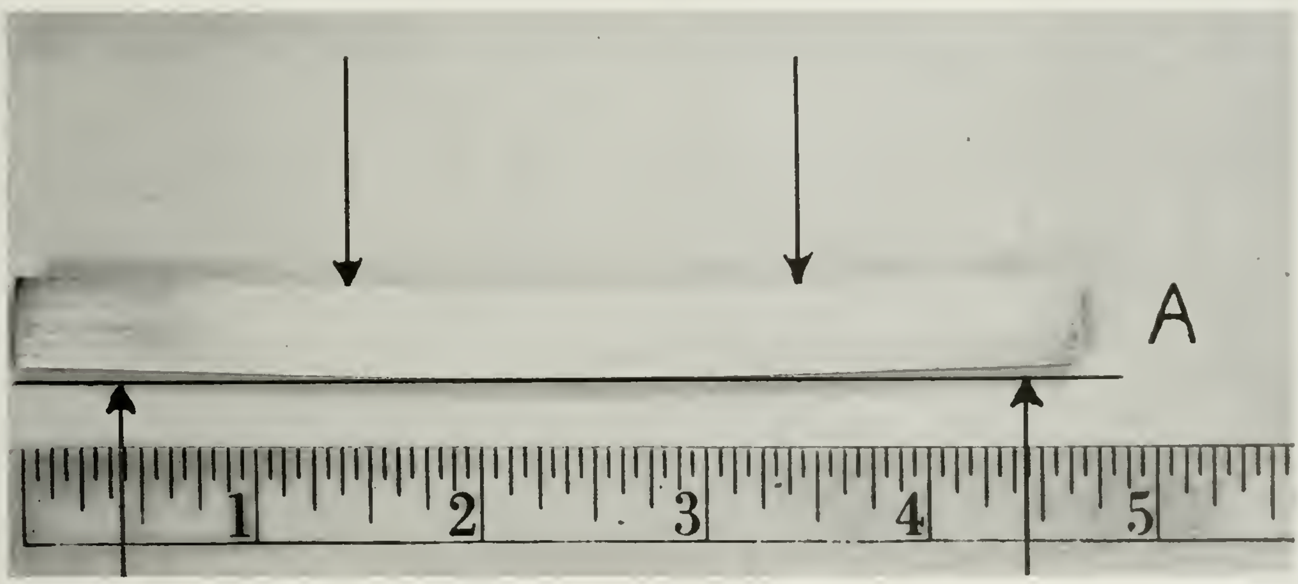
After tempering, the specimens were carefully surface ground to approximately 0.375-in. square. An open structure wheel, frequently diamond dressed to insure free and cool cutting conditions, was used. At no time during the grinding did the specimen feel uncomfortably warm to the touch.

The ground specimens were then tested in a fixture designed to provide a constant bending movement over the middle 2 in. of a 4-in. test span. A hand operated testing machine was used to load the specimens, the loading rate being from 600 to 700 lb. per min. until (and if) failure occurred. Since the capacity of the machine was only 12,800 lb., two specimens were not broken.

The calculated modulus of rupture takes into account all errors introduced by roll on the supports and loading points. The modulus of elasticity as calculated from the deflection data (in the elastic region of the test) ranged from 29,500,000 to 30,500,000 psi., a very satisfactory check. The results of the different tempering treatments are shown in the following table:

Test	Modulus of Rupture	Rockwell Hardness	Deviation from Avg.	Deviation, % of Average
		Double Temper—Slow Heating		
1,unbroken	542,500 psi.	C-65.9	+4900 psi	Over +0.91
2	533,500	65.6	−4100	0.76
3,unbroken	540,500	65.4	+2900	Over +0.54
4	534,000	65.9	−3600	−0.67
Average:	537,600+			
		Double Temper—Fast Heating		
1	503,000 psi.	C-65.9	+ 3200 psi.	+0.6
2	482,000	65.9	−17,800	−3.6
3	478,000	65.5	21,800	4.4
4	538,000	65.8	+38,300	+7.6
Average:	499,800			
		Single Temper—Slow Heating		
1	401,000 psi.	C-65.5	53,000 psi.	11.68
2	469,500	65.3	+15,500	+ 3.41
3	463,500	65.5	+ 9500	+ 2.09
4	482,000	65.5	+28,000	+ 6.16
Average:	454,000			
Untempered	85,000 psi.			

Fast heating, as the term is herein interpreted, consisted of an average heating rate of about 90°F per min., though the maximum rate was 240°F per min. in the range of 100 to 600°F—the range in which the hardened specimen can least readily accommodate the volumetric changes brought about by heating.



The desirability of slow heating for tempering is borne out by the results, although the increase in bending properties due to slow heating is comparatively unimportant under the test conditions. A survey of the results of slow vs. fast heating reveals that slow heating is superior with regard to both average strength and consistency of results. The total variation (maximum to minimum) of the slow heated samples was somewhat over 9000 psi. whereas the fast heated test beams revealed a total variation of about 60,000 psi.

A comparison of single and double tempering, both under slow heating conditions, shows that a definite benefit accrues when double tempering is used. The average strength is some 84,000 psi. higher, and the total variation is but 9000 psi. as compared to some 81,000 psi. for the single tempered samples. The improvement is definite though not as pronounced as may have been expected.

The writer believes, on the basis of magnetic study, that the transformation of retained austenite in this steel, on cooling from tempering, occurs in the range of 500° to 550° F, and transformation in such a range permits appreciable stress relief in the martensite so formed. Of course, volumetric changes brought about by this transformation may still affect the remaining material and cause weakening due to very small cracks.

The benefits of double tempering would, of course, be much more pronounced on irregularly sectioned tools and dies. Spalling at sharp sectional changes ought to be much less when such tools are double tempered.

As a matter of curiosity one test bar was hardened, ground, and tested without any tempering whatever. The modulus of rupture obtained on this bar was approximately 85,000 psi., indicating the folly of using untempered high speed steel.

The accompanying photographs show two tested beams. One specimen did not break at an extreme fiber stress of 542,500 psi. Yielding began at a stress of about 400,000 psi. and progressed gradually. The maximum deflection under load amounted to nearly ¼ in. with 0.050 in. of permanent set remaining after the load was released. The other beam failed at an extreme fiber stress of 533,500 psi. Note the fragmentation of the section which was subjected to a constant bending moment; the specimen virtually exploded at failure.

NEW E.E. DEPARTMENT HEAD

Now the Chief Signal Officer of the United States Army Signal Corps, William Littell Everitt will soon assume the title of Professor and Head of the Department of Electrical Engineering at the University of Illinois. A man of six feet and 196 pounds, he is a good looking, pleasant person to know.

Professor Everitt is exceedingly well qualified, as his background will show, for the position he will occupy. He chose to come to the University of Illinois even when Yale was offering him a similar opportunity. Professor Everitt graduated from Cornell University in 1922 with the degree of Elctrical Engineer, and he received the M.S. degree from the University of Michigan in 1926 and the Ph.D. degree from Ohio State University in 1933. He is a member of Tau Beta Pi, Sigma Xi, and Phi Kappa Phi. Dr. Everitt was on the teaching faculty at Cornell University from 1920 to 1922, at the University of Michigan from 1924 to 1926, and at Ohio State University since 1926. He has had engineering experience with the New York Telephone Company, the North Electric Manufacturing Company, and with the American Telephone and Telegraph Company. Since 1942 he has been Chief of Operational Research in the office of the United States Army Signal Corps. He is the author of the following books: "Communication Engineering," "Fundamentals of Radio;" and a section on Telephony and Telegraphy in the Standard Handbook for Electrical Engineers, as well as of numerous scientific and technical articles.

Professor Everitt will not assume his duties in the department until he has been released from the work he is now doing in the United States Army Signal Corps.

Place: Machine design room.

Greffe: "If you start at a given point on a given figure and travel the entire distance around it, what will you get?"

Rich: "Slapped, sir."

Are you a SQUARE PEG?

By ROBERT AHERN, Met. '45

All around us are examples of misplaced manpower. There are teachers who should be bookkeepers, storekeepers who should be lawyers, drill press operators who should be dentists. Selection of an occupation has too frequently been made by circumstances, by ambitious (or uninformed) parents, or by the lure of "easy money," with little regard to the candidate's natural ability. The emphasis on production and distribution costs has all but buried the most glaring inefficiency of all—the improper utilization of man's own brainpower and skill. For many years, psychologists have been studying this field, but only recently have answers begun to emerge from the masses of accumulating data. One of the better known systems is that of Dr. Johnson O'Connor, which began while he was testing workers for a large manufacturing firm.

From his tests has evolved the Human Engineering Laboratory, at Stevens Institute of Technology, Hoboken, N. J. Since the original laboratory was established, branches have been extended to Boston, Chicago, Washington, and field activities are carried on over most of the United States. The Laboratory's aim is to make a comprehensive inventory of a person's aptitudes and potential capabilities. From the results of the inventory, the Laboratory tries to help a man choose a life work in which he is most likely to be successful and happy. They do not, however, give positive advice unless the aptitude pattern is obvious. Aptitudes should not be confused with achievements, in that aptitudes are inherent and cannot be acquired. If you were examined by the Laboratory, the tests would doubtless include these:

1. Type of personality
2. Engineering ability or structural Visualization
3. Accounting or clerical ability
4. Creative imagination
5. Inductive reasoning
6. Tweezer dexterity
7. Finger dexterity
8. Observation
9. Visual memory
10. Tonal memory

But for our purposes, this discussion is confined to those most concerned with engineering.

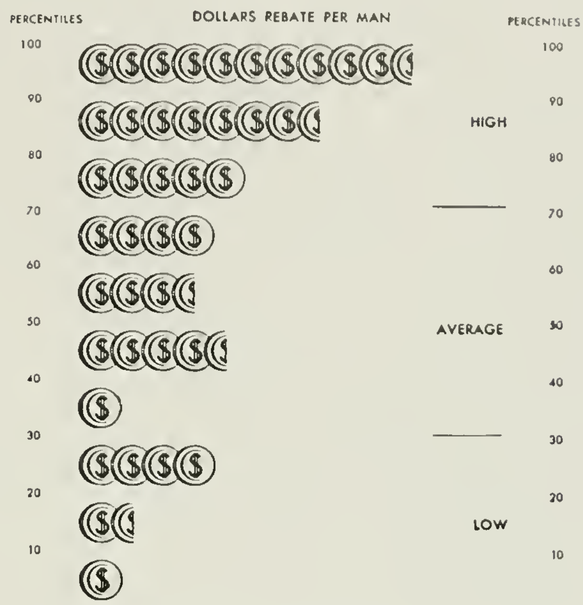
They may also test you for interest, but far too often this is misleading and is no guide to aptitudes. Interests are constantly changing, whereas aptitudes remain constant throughout life.

Personality is not an aptitude. It is defined as the way in which one thinks, and governs whether he is more contented with group contacts or in individual work. The subjective person thinks of things in terms of his personal reactions, and prefers to work alone. The objective person things of things in more general terms and prefers working with other people. The testing of personality is of great importance. Salesmanship, high school teaching, and social activities require an objective personality, while writing, engineering and scientific work require a subjective personality.

Imagine that you are taking the battery of engineering tests that are given to thousands yearly by the Human Engineering Laboratory.

First, you may be tested in personality. The test is simple, consisting merely of the examiner reading a list of words to you and noting your response. The test words have no connection with each other, but from the responses your personality can be determined. If you are of subjective

BOYS HIGH IN STRUCTURAL VISUALIZATION SUCCEED IN ENGINEERING SCHOOL



This chart is based on the same group of engineering-school students at Stephens Institute of Technology. Each symbol represents $10 awarded per man in tuition rebates.

personality you will answer with words that directly concern yourself. If you are objective in personality, you will answer in impersonal and general terms.

The third test may be the accounting aptitude test, which is really a negative approach to engineering aptitude. You are asked to glance at two columns of numbers, beginning with numbers of two digits, and ending with numbers of nine or more digits. The object of the test is to determine, as rapidly as possible, if the numbers are the same or different. Your score is determined according to the time used for the test. The Laboratory is certain that this test measures the inherent aptitude because it excludes the working of actual problems which would be influenced by practice and schooling. People high in accounting aptitude are rarely found in engineering, but tend toward bookkeeping, statistics, banking, proof-reading, or printing.

To test your creative imagination, you may be asked a question such as, "Suppose the earth were suddenly to stop turning on its axis; what ideas does this suggest to you?" You then either scribble your ideas on paper as rapidly as possible, or else stare blindly into space. After five minutes, your test is scored and recorded. Creative imagination is found in writers, salesmen, research engineers, and teachers, but is definitely lacking in foremen and accountants.

Next, your engineering aptitude or structural visualization is tested by use of the wiggly block, which is a block of wood, about the size of a thick dictionary, that has been cut into nine pieces in wavy lines, similar to a three dimensional jig swa puzzle. You watch the examiner as he slowly disassembles and shuffles the pieces and passes them to you to be reassembled. If you are high in structural visualization, you may assemble them in two or three minutes, if low, you may require six to 10, or even 30 minutes. Surgeons, dentists, diemakers, and engineers score high in structural visualization, while doctors of philosophy, and even executives in charge of vast industries, score very low.

Finally you are tested for inductive reasoning, the test consisting of pictures of six familiar objects from which you choose the three that are bound together by some common characteristic. You are scored according to the time you take. Among those high in this aptitude are college, engineering, and high school teachers.

Although vocabulary is not one of the inherent aptitudes, the Human Engineering Laboratory considers it of utmost importance and urges one to improve it. Vocabulary seems to have a higher correlation with success in all fields than any other trait. Executives seem to have larger vocabularies than any other group, higher even than college professors, journalists, and writers. Engineers should be high in the vocabulary of physics and mathematics.

Two or three weeks after you have completed the tests, the Laboratory will send you the results, perhaps with some definite advice. If they are not satisfied, you may be asked to return for conferences and retesting, but after this, the decision is your own.

Similar work is being done by the Personnel Bureau, here at the University of Illinois, but the individual tests differ. For example, the Bureau uses the Minnesota paper form test instead of the wiggly block for an estimate of structural visualization. The Bureau is more cautious in interpreting the results of its tests than is the Human Engineering Laboratory. This may be because of insufficient data on which to base conclusions. However, it must be said in fairness to the Laboratory, that they admit there is much to be learned.

These tests apply to all ages, and perhaps one of the steps to take with youngsters about ten years of age, is to have them tested by a reputable consultant, so that they may have a real opportunity to select their field and have some definite goal toward which to work.

No one can predict whether you will be successful in engineering or any other field, but by finding your aptitudes and capabilities, steps toward attaining the knowledge and skill necessary for success, can be taken. It is desirable, almost imperative, in order for you to be truly happy and successful, that you use all of your aptitudes. Numerous cases can be cited in which individuals who were in jobs that required only a few of their aptitudes were progressing very slowly, but after they changed to a job that used all their aptitudes, they became top-flight men in their field.

ENGINEERING STUDENTS WITH HIGH VOCABULARY SCORES EARN HIGH TUITION REBATES

What is College . . .

A true college education isn't composed entirely of the knowledge gained in the classroom. Rather it consists of an experience of living and working with others. In order to obtain the full benefit of this experience, the student must engage in extra-curricular activities of some nature. The opportunities on our campus are many and varied.

I do not mean to imply that a student should spend all his time on work outside the academic realm. Obviously, that would defeat the purpose of attending college. Neither should he spend all his time "hitting the books." A five point is an admirable goal, but one that isn't frequently obtained. A balanced blend of the two is desirable.

This outside work has many advantages. First, it is assumed that the student chooses a type of activity in which he is interested. By this participation he learns how to "get along" with others, but gains much practical knowledge as well. Acquaintances are made which may be of great value some time in the future. Oftentimes, the student becomes better acquainted with his professors, and learns to his amazement that they are human, too. Usually, he has occasion to apply some of the knowledge he has gained in the classroom.

When a potential employer investigates a man's college record, he is interested not only in his grades, but also in his activities. Often, other things being equal, the deciding factor will be the initiative and leadership which he has displayed by his participation in extra-curricular collegiate activities.

Last, but not least, is the feeling of belonging, of being a part of something, that the student gains. After graduation, when he returns to the campus or even recalls to mind his college days, the things he will cherish are the memories of the happy times he had as a member of a publication staff, a social or musical organization ,or whatever activity in which he was active.

A soldier went into the barber shop after a 30-mile hike. He slumped down into the chair.

"Give me a shave," he said.

The barber told him he was too far down in the chair for a shave.

"All right," said the soldier wearily, "give me a haircut."

* * * *

"But, Doc," argued the sailor, "I'm only here for an eye exam. I don't have to take off all my clothes for that."

"Strip down and get in line," shouted the pharmacist's mate.

The sailor obeyed, but kept on grumbling. The chap in front of him finally turned around and said: "What are you kicking about? I only came here to deliver a telegram."

This chart is based on 298 engineering-school students tested as undergraduates at Stephens Institute of Technology. The top thirty-two in wiggly-block scores earned a total of $3,350 in tuition rebates awarded for a combination of high scholarship and notable extra-curricular activities. This equals approximately $105 per man, represented by the horizontal row at the top of ten and one-half symbols, each of which stands for $10. The bottom thirty-one men in wiggly-block scores earned a total of only $250, awarded in the same manner, or less than $10 per man shown by the lone symbol at the bottom.

POWDER METALLURGY

By WAYNE NEELY

"Powder metallurgy is the art of making objects by heat treatment of compressed metallic powders with or without the addition of a nonmetallic substance. It may be applied to a single metal powder or to complex mixtures and the pressing operation may be carried out at ordinary or elevated temperatures. In many cases the results obtained by the use of this method are identical with those obtained by the orthodox methods of melting and casting. In many other instances, however, properties are developed which heretofore, were unattainable."[1]

The first recorded use of powder metallurgy was in 1829 when an Englishman named William Hyde Wollaston made objects from powdered platinum. He used powdered metal because the crude furnaces then in existence were unable to develop the terrific heat (3224°F) necessary to melt platinum. After better furnaces were developed, however, the process was discarded. It was not until 1866 that powdered metals were revived. At that time the art was developed almost simultaneously in both Germany and Sweden.

WAYNE A. NEELY

Wayne, who hails from Oak Park, Illinois, came to the University of Illinois in November, 1943, as a V-12 student. Although he only spent two semesters here, he distinguished himself scholastically by becoming a member of Pi Eta Sigma, freshman honorary, and by obtaining a 5.0 average. At present Wayne is in the V-12 program at Northwestern university, where he is studying mechanical engineering.

Then, in 1910, American scientists further revived powder metallurgy as the only practical way of making ductile tungsten for use in the electric light industry. During the last war Germany utilized this process in making cemented-carbide machine tools. Since these tools were so much harder and heat resistant than the high-speed steels then in use, Germany could produce weapons of war faster than the Allies could on the same amount of industrial equipment. In 1926 Germany's Krupp gave assistance to American development of powder metallurgy. The next year the American automotive industry used metal powders to produce oil-less bearings. From that date on the progress of powder metallurgy has been rapid.

Virtually all of the common metals are produced in powder form at the present time. The various processes used in obtaining these powders are all highly technical. They include grinding, stamping, precipitation, atomizing, spraying, electrolysis, condensation, and reduction. The method used depends upon the chemical characteristics of the metal and the manner in which it is to be compounded.

Purity of the metals involved is of the utmost importance in powder metallurgy. Purity is essential since clean surfaces are necessary if the finished item is to have ductility and tensile and shear strength.

After the metals are in powder form they are mixed in the exact proportions desired in the finished alloy. Powders are usually mixed in either tumblers or ball mills, and the time required for treatment varies from a few minutes to a number of days.

The next step in the process is one of the most important. The dust-like raw material is placed in a die set in the table of a press and then subjected to terrific pressure. In actual practice, pressures vary from five to one hundred tons per square inch. A solid gear four inches in diameter, therefore, woul drequire as much as 1200 tons of pressure. The largest presses in use in 1941 and 1942 had capacities between 80 and 120 tons, although presses of 400, 600, and 800 tons capacity are probably not uncommon today.

After the pressed piece is ejected from the die it is still relatively fragile. The part has strength only after it has received a special heat treatment called sintering. Sintering is a consolidating heat treatment at a temperature below the melting point of the metal. For small objects the heat treating process takes about 30 minutes, while the temperature is held at approximately two-thirds the melting point of the metal. During sintering the part may contract as much as 20 per cent; however, this shrinkage can be controlled to within a few thousandths of an inch.

There is as yet no definite agreement as to what occurs during the sintering process. One explanation of the phenomenon is that when the surface area is increased by the powdering process there is a quantity of free surface energy present which is roughly comparable to surface tension in liquids. Under the double action of heat and pressure there is an interlocking of atoms within the mass, producing a strong weld.

A notable example of how powder metallurgy has created a superior product is the cemented carbide. These machine tools are alloys containing tungsten and lampblack (carbon) mixed with a cobalt binder. Tantalum and titanium are often added. All of these elements possess high melting points; therefore, they cannot be united except by the powder metal process. When the powder is subjected to a pressure of about 60,000 pounds per square inch and sintered at 1500°F it can be machined and cut to the desired shape. Then the formed piece is given a final sintering at 2700°F.

The finished product is of a hardness between that of diamond and sapphire, and will retain a cutting edge when heated to 3000°F. Such tools, consequently, will outlast and cut faster than the ordinary high-speed steels. One tungsten carbide die used in cold nosing heavy calibre shells has already machined more than one million such shells without serious wear.

Perhaps the best known product formed from powdered metals is the oil-less bearing. Millions of such bearings are in use on modern automobiles, as well as countless other machines. These bearings are an alloy of copper, tin, and graphite which is mixed with a volatile before pressing. Upon sintering, the volatile is driven off, leaving a network of minute cells. After sintering the bearings are quenched in lubricating oil. In this quenching operation the sponge-like metal absorbs oil up to 35 per cent of its volume by capillary action. Such a bearing will often outlive the machinery of which it is a part.

Besides the obvious advantages of the above examples, powder metallurgy has numerous other advantages. It often saves valuable man-hours, as in the case of certain articles manufactured by the Chrysler Corporation. "One of the pieces on a gun sight, if made by conventional methods, must go through five different machines—a screw machine, drill press, milling machine, broacher, and profiler. Making it from powdered metal is a quick, simple process."

At the same time strength is not greatly reduced. In some cases, such as the production of tungsten wire, the strength is greater than that attained by any other method. In the manufacture of such wire a bar of tungsten is pressed and sintered. Then it is hot swaged and further reduced by drawing through tungsten carbide dies. When the wire goes through a final drawing it attains a tensile strength of 600,000 pounds per square inch in a wire .0005 inches in diameter.

One of the disadvantages of conventional metallurgy is that the component metals of an alloy tend to lose their individual characteristics. In powder metal process, however, such is not the case. By taking copper, which is a good conductor, and combining it with a good resister to heat such as tungsten, a superior product can be manufactured which can be used to advantage in the welding industry. Normally such an alloy could not even be attempted, since the melting points of copper and tungsten are so different.

There are several other advantages which powder metallurgy has over other methods. Alloys can be obtained in the exact proportions desired. Bronze, for instance, can be made which has a uniformity of composition unobtainable by foundry methods. This process also eliminates impurities introduced by standard metallurgical methods. Besides the processing of alloys which have widely divergent melting points, combinations of metals which are immiscible in the liquid state, can be made.

Against the advantages of powder metallurgy must be weighed its disadvantages and limitations. Up to a few years ago powdered metal production was confined to items weighing less than three pounds. Today, however, pressings weighing up to 63 pounds have been successfully reproduced.

Such large castings, however, demand enormous pressures, which in turn means large, expensive presses. Up to now the cost of such presses has greatly retarded the expansion of powder metallurgy. Along with the increases in pressure has come the problem of die maintenance. Such dies must have high strength and great wear resistance, which increases die cost.

Many shapes cannot be formed because they cannot be extracted from the dies. Also, powders do not flow evenly under pressure; therefore irregularly shaped pieces of varying thicknesses are impossible. Another great limitation of the process is the high cost of the raw materials involved. The average premium on powders range from seven to ten cents a pound. In the case of iron, therefore, the powder costs seven times as much as the ingot iron.

The future of powder metallurgy, nevertheless, is bright. Already, there are numerous developments which will have a large post-war market. A typical example of these developments is the ribbonless typewriter. Since porous metal absorbs oil, it was thought that it would also retain ink. The result was a ribbonless typewriter in which the type was extraporous bronze. Experiments showed that such a typewriter would write several hundred thousand words before re-inking was necessary.

The real future of powder metallurgy may well depend upon hot pressing, which still is in the laboratory stage. Materials made by the cold press process are generally low in density, tensile strength, hardness, impact strength, etc. Hot pressing, however, results in better physical qualities without losing the advantages of the cold press process. It has been found that when the pressing and sintering operations are combined, pressures of only about 10 per cent of those normally used are sufficient. Hot pressing, therefore, would result in larger objects at a lower cost and requiring fewer man-hours.

"Frequent water drinking," said the specialist, "prevents you from becoming stiff in the joints."

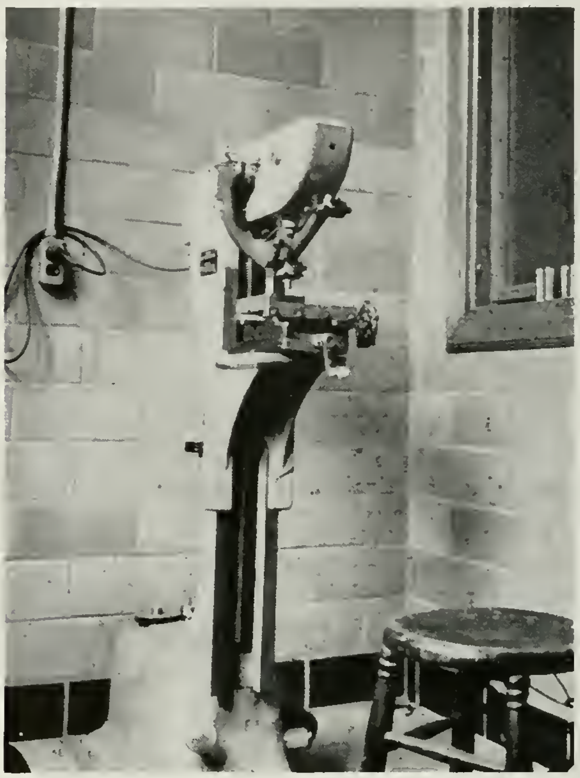
"Yes," said the co-ed, "but some of the joints don't serve water."

Then there was the young bride who casually commented that her husband never snored before they were married, and couldn't understand the roar of laughter that followed.

(Continued from Page 8)

from the bellows and screen. Considrable knowledge and experience is necessary for taking micrographs of sufficient magnification and detail.

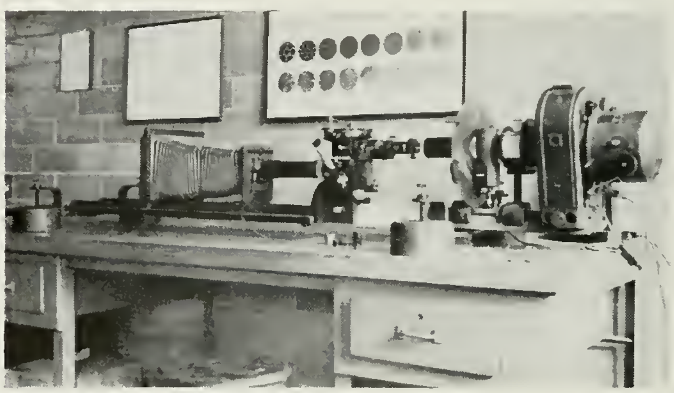
If a specimen has a strain gradient, heat affected zone, fracture, or other features that can be readily seen without



magnification or with relatively small magnification, the micrograph is used to photograph it. It consists of a base for the specimens a lamp bank for illumination, a focusing arrangement and a time shutter and lens. The lights are turned on, the specimen is placed upon the base, the shutter is opened, and the image is brought to focus on the ground glass back. Magnifications up to 10 diameters are easily obtained, and photographs can be taken in the same manner as with the metallograph.

The procedures mentioned above are ones connected with research metallurgy or with testing of sample specimans from working heats. These operations are of extreme importance but are not so numerous as those in the phases of extractive or adaptive metallurgy.

What's with metallurgy? Perhaps to some this question raises a doubt; but to others, there is no doubt or question but a clear realization that metallurgy has a definite place in science and industry.



METALLOGRAPH

1. Your telephone in peacetime reaches 95% of the world's telephones and over 26,000,000 in the United States today.

2. You fly with greater safety because of radio telephony between plane and ground —demonstrated by Western Electric in 1917.

3. You ride more safely on the nation's railroads because of Western Electric train dispatching telephone equipment.

Out of 75 years of manufacturing experience

4. You hear radio news and entertainment. Since radio began, W. E. engineers have helped build broadcasting equipment.

5. You enjoy added protection today thanks to Western Electric inter-city police teletype, and radio in police cars.

6. You can enjoy talking pictures—made commercially possible back in 1926 by Western Electric development.

7. The hard of hearing can live more fully with a Western Electric hearing aid, perfected through telephone research.

8. You will enjoy television. This picture shows how W. E. equipment sent images by radio as long ago as 1927.

...come these contributions to better living

For many years, Western Electric engineers have devoted their skill to the production of telephones and the vast network of telephone equipment used by the Bell System. At the same time they have developed the manufacture of related products which also have contributed materially to better living. Some are pictured here.

Today Western Electric engineers are doing their greatest job—guiding the production of huge quantities of electronic and communications equipment that help our fighting men win battles—help save American lives—help maintain the vital home front communications networks, and bring nearer the day of final victory and peace.

When that day comes, the men and women of Western Electric will resume their 75-year-old job of making communications equipment to further enrich your life.

1869 1944

75TH ANNIVERSARY

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

ARMY E NAVY

Buy all the War Bonds you can—and keep them!

PROFESSOR HAROLD L. WALKER

At first glance one can feel that Professor Harold L. Walker is a congenial sort of fellow who knows what he is talking about. As to knowing what he is talking about, surely a record of twenty-five technical papers, a contribution to the Encyclopedia Britaanica Junior, and an active membership in nine societies and four honorary fraternities would be some indication that he was well up on the score.

Some of the societies that "Johnny" (a nickname that some of his intimate friends gave to him, as a result of a humorous incident, a nickname that seems not only to have stuck with him but also to have met with his approval) belongs to are: A.I.M.E., A.F.A., A.S.M., (chairman of Peoria Chapter from 1940-1941), British Institute of Metals, Society for Promotion of Engineering Education, Illinois Society of Engineers, National Professional Engineers, Illinois Academy of Science, and Illinois Mining Institute; and the honorary fraternities that claim his membership are: Sigma Xi, Tau Nu Tau, Sigma Rho, and Alpha Sigma Nu.

Having attended Benton Township High School at Benton, Illinois, and the William G. Mather High School at Munsing, Michigan, he went on to the Michigan College of Mining and Technology and from there to the University of Michigan where he earned a B.S. and an M.S. degree in Metallurgy. He is now Professor of Metallurgy and head of the Mining and Metallurgy department here at Illinois. Aside from his positions at Illinois, he is an official member of the staffs of the Washington State College and the Michigan College of Mining and Technology.

Although born in Illinois, he left the state and established residence wherever his positions carried him for about twenty years, returning to Illinois during the year 1938 to take the position in the Metallurgy department that he now holds.

As for hobbies, "Johnny" seems to think that photography and outdoor field sports are about the best. Evidence of this is the Speed Graphic camera that stands in one corner of his office ready for use at a moment's notice, and his immediate willingness to discuss dogs, guns, and game. Probably, of the two hobbies, he enjoys the latter more, for the mere mention of a trek through the fields brings forth a period during which there is a delightful exchange of "field tales."

Probably the most interesting thing about his method of instruction is the insertion into the daily lessons of actual experiences which he has had with metallurgists in the field. Such things as "secret formulas" for production of a beryllium steel alloy, or witchcraft in brass smelting make the student metallurgist realize just exactly where and how a knowledge of physical metallurgy can be applied, not only in plant production, but also in everyday life.

WILLIAM ALBERT OLIVER

William Albert Oliver, associate professor in Civil Engineering at the University of Illinois, was born in Ontario, Canada; and to quote him, "The date has no bearing on the issue." He is a naturalized citizen of the United States. Professor Oliver graduated from the University of Michigan where he received his degree of B.S.E. in Civil Engineering, majoring in structures. His graduate work was done at the University of Illinois from which he received his M.S. degree.

As a young graduate of the University of Michigan, Bill's first job was on the construction of an addition to the American Malleable Company's building at Owasso, Michigan, where his title was Works Engineer. After that he taught mathematics for two years at Beloit College, Beloit, Wisconsin. From Beloit, Bill went to the State Architect Office at Columbus, Ohio, back to a consulting engineer's office in Appelton, Wisconsin; and after a year of graduate work at the University of Illinois, he taught structure design and analysis at the Case School of Applied Science. He has taught at the University of Illinois since 1929 and is an associate professor in the Civil Engineering department.

Liked by all of his students, he is affectionately known as "Wild Bill" outside the classroom. Principally because of the way he keeps his classes hopping from bell to bell, with perhaps a shade of admiration for his ability to get along without a slide rule up to about five digits, he ranks as a favorite among his students. His most enjoyable pastime is listening to classical music; Wagner operas are his favorites. Bill also likes to harmonize in "barber shop" singing. He still says his wife is his best girl and he is very proud of his three children; he has a 20 year old daughter at the University of Michigan, an 18 year old son in the navy, and a 12 year old son who hasn't yet quite talked his father into letting him join the navy.

The students Bill teaches realize their good fortune in having him as their professor and the University department looks with pride and admiration to William Albert Oliver, one of their own.

25 Years that Created a New World of Radio 1919-1944

From 1919 to 1944 . . . RCA has pioneered in the science of radio and electronics . . . from world-wide wireless to national network and international short-wave broadcasting . . . from electron tubes to electron microscopes and radiothermics . . . from the hand-wound Victrola to the automatic radio-phonograph . . . from television to radar.

Twenty-five years of service to the nation and the public have made RCA a symbol of achievement and progress . . . RCA is a monogram of quality in radio-electronic instruments and dependability in communications throughout the world.

From the First World War to the Second, RCA developed and expanded its "know-how" in skilled engineering and production so vitally needed to meet the demands of war . . . these qualities will be reflected in the peacetime products of RCA.

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30 ROCKEFELLER PLAZA, NEW YORK CITY

RCA LEADS THE WAY . . In Radio . . Television . . Phonographs . . Records . . Tubes . . Electronics

RCA
1919 1944
25 YEARS OF PROGRESS IN RADIO AND ELECTRONICS

KENNETH J. TRIGGER

About thirty-four years ago in Carsonville, Michigan, a small town located north of Detroit in the "thumb," Kenneth J. Trigger was born. During the early days of his youth nothing particularly significant or outstanding occurred. It was at Carsonville High School that "Trig," as he is usually called, combined scholarship with athletics, being in the honor society as well as playing varsity football, baseball, and track.

After being graduated in 1929, Trigger matriculated at Michigan State college, where he studied mechanical engineering. His consistently high scholarship and pleasing personality qualified him for membership in Phi Kappa Phi, Pi Tau Sigma, Sigma Tau, and Tau Beta Pi. He was also a member of the student branch of the A.S.M.E. In addition, Trigger belonged to a local social fraternity, which is now affiliated with Sigma Chi.

Following his graduation with high honors in 1933, Trigger spent the next two years as a graduate assistant in mechanical engineering at M. S. C., and during the summers he worked at the Michigan Engineering Experiment Station. At this time he became a member of Sigma Xi, national research fraternity. After obtaining his masters degree in 1935, Trigger was an instructor in mechanical engineering at Michigan State college and also taught one year at Swarthmore college and another year at Lehigh university. Then, in 1938, he came to the University of Illinois as an associate in mechanical engineering, where a year later he assumed his present position in charge of the beat treating and welding laboratories.

Trigger has done diversified research in the heat treatquenching, and transverse strength, and "deep freezing" of high speed steels, the machineability and physical properties of sulfur steel; and tests of cutting temperatures and tool life. Numerous articles on various phases of heat treatment written by Trigger have been publishd in technical periodicals. In 1943 Trigger completed the requirements for the professional degrees of Mechanical Engineer.

For two years Trigger conducted war production courses on heat treating at the University of Illinois. At present he travels periodically to Springfield, where he is leading a group of Allis-Chalmers foremen on a discussion of supervisory training.

About five years ago Trigger married his college sweetheart, a Michigan girl, and he and Mrs. T. are now being ordered about by their three-yar-old son, Jim.

Trigger is truly a can of societies, being vice-chairman of the Central Illinois A. S. M. E., honorary chairman of the local student branch of the A. S. M. E., and member of the A. S. M. and S. P. E. E. (Society for the Promotion of Engineering Education). In addition he is a Mason, and a member of the Champaign-Urbana Kiwanis club.

During the golfing season Trigger is often seen at the Urbana Country club, frequently accompanied by Professor Ryan, also of the M. E. department. Although Trigger shoots in the high eighties, he says he has to spot Ryan too many strokes. In his spare time he putters around his rather successful vegetable garden. Trigger is also a hunting and fishing enthusiast. For additional recreation of a less active nature he enjoys contract bridge, but admits only a mediocre ability for poker. Although he is not a musician, Trigger appreciates classical music. Among his favorite composers are Beethovn, Haydn, and the modern Russians—Prokofiev and Stravinsky.

GUENTER SCHWARTZ

"Schwartz speaking" is the accented reply that Dr. Guenter Schwartz gives as he answers the telephone. And if the person on the other end of the telephone conversa-

tion knows little more about the man he is talking to than that it is just Dr. Schwartz of the physics department, he misses knowing a personality who is refreshing, wholesome, and witty.

Dr. Schwartz leaves an impressive and vivid print on the memory of anyone he meets. It is not only a striking first impression, but a picture that is profound and growing with each new experience you have with the doctor. It matters little whether Dr. Schwartz is lecturing to you while in a physics class, walking down the street with you, or chatting with you while you sip coffee, his clever mind and deep sincerity are the unmistakable qualities you find in this man. His blue eyes have an expressiveness about them that quickly changes from the seriousness of an important discussion to the merriment of his ever-present humor.

Dr. Schwartz is a congenial gentleman of five feet seven inches and 145 pounds who likes to wear casual clothes. He combs his jet black hair back from his semi-high forehead in a smooth pompadour. His shoulders are broad and straight and he carries them back as he walks. His hands are those of an artist's, for before the doctor majored in physics, he was a talented musician.

The doctor was born in Cologne, Germany, November 26, 1913. The picturesquesness of the Rheinland was very impressive to Dr. Schwartz. The colorful carnivals with their gayety, shows, and nightly dancing, together with places like the famous Cologne Cathedral, still predominate in his memory. It was in Cologne that his education began; he spent a year and a half at the university there. After Cologne, Dr. Schwartz spent a year at Goettingen University, the most famous of all German institutions of higher learning; he then studied three more years at Berlin University which was much like the renowned American M.I.T. There, in 1938, Dr. Schwartz received an engineering diploma. His thesis was on the electron microscope. A scholarship at Johns Hopkins University brought Dr. Schwartz to America in September, 1938; and he received his doctor of philosophy degree in February, 1942. His thesis for this degree was "A New Precise Determination of h e." He remained at Johns Hopkins until August; then he married and came to teach at the University of Illinois.

Dr. Schwartz is extremely talented in playing the piano and organ, and this art takes up most of his time when he is not busy with university activities.

He is very much interested in young humanity and is active in leading the fire side forum of the YMCA. Many times he and his wife can be found acting as chaperons at dances, lending ease and friendliness to the gathering.

And it's this man of learning and experience, warmness and whole-heartedness who leaves you with the satisfying feeling that you are always welcome to come back and talk with him, as a friend whose advice is as helpful and honest as his merriment is refreshing and entertaining. That is Guenter Schwartz.

HE HELD HIS HEAD HIGH

Herb Newmark, acting editor for the first issue of the Technograph, has joined the armed forces. His enthusiasm and energy made it possible for an otherwise inexperienced staff to start the magazine on its sixtieth year of publication. It was a pleasure to be associated with him. Even with the draft board breathing on his neck, Herb went right along, cheerful as ever. His work on the Technograph and the Illini Board of Control testify to his social control, and the records in the registrar's office show that he kept even with his better than four point average. He didn't want to leave, but he did not complain.

These are times that show people up for what they really are. Herb Newmark, and many like him, have shown a state of mental health that is refreshing. Weaker spirits have crumbled under pressure. Some have cut loose from normal obligations for a "last fling." Others have exhibited a distressing self-pity bordering on hysteria.

For the Herb Newmarks, we predict useful careers, in the armed services, a rapid readjustment to civilian life, and a future unbounded by the petty fears of lesser men.

THE CONSTELLATION

The four 2,200-horsepower engines roared smoothly. Slowly the great shark-bodied airplane, gleaming silver in the lights of the Burbank, Calif., airfield, moved forward, gathered speed, climbed into the air and headed east.

Exactly 6 hours and 58 minutes later the plane roared over the runways of the Washington National airport and glided to a landing. A new transcontinental record had been set, and people all over the country looked at one another over their evening papers and said, "The world really is getting small, isn't it?"

What this plane, dubbed the "Constellation," and owned by Transcontinental and Western Air, Inc., will mean to postwar travel is gleaned from a few figures. Following the Great Circle route with intermediate stops, it will carry 50 passengers and their baggage from Washington to London in 13.5 hours; to Moscow in 19.33 hours; to Chungking in 35.25 hours; to Melbourne in 42 hours. It can carry 100 fully equipped soldiers.

Our Societies . . .

TAU BETA PI

Tau Beta Pi, Engineering Phi Beta Kappa, during the past semester has initiated ten new members: Lowell Ackman, V-12, E.E.; LeRoy Buzan, V-12, E.E.; William Frey, V-12, C.E.; Walter Crum, V-12, C.E.; Don Hamer, V-12, Cer. E.; Norm Jone, V-12, C.E.; Richard Medal, E.E.; Paul Monohan, V-12, C.E.; Paul Shadle, and August Uttich, V-12, Chem. E.

Among the members who have been graduated in October are: Dick Conklin, former president, Hershel Herzog, and Ralph Porter, all three of whom are civilians. The Navy V-12 graduates include Richard Ball, Royce Beckett, John Giachetto, John Harder, Fred Liederbach, and Wendell Wilson.

For the present semester the officers are:

Norman Jones .... *President*
William Frey .... *Vice-President*
Don Hamer .... *Secretary*
Bob Laplante .... *Treasurer*

PI TAU SIGMA

Pi Tau Sigma, national mechanical engineering fraternity, has initiated nine new men during the summer semester, all of whom are from the Navy V-12 unit. The initiates are: Jerry Davis, Bob Fouts, Jerry Jenkins, Bob Hayes, Frank Holecek, Fred Lindstrom, Mike Martus, Dick Oberto, and Al Weber. The initiation banquet, held in conjunction with Chi Epsilon, took place last September. The principal speaker, Dr. R. P. Fischer, talked on the meaning and place of Psychology today.

Among the active members of Pi Tau Sigma who have left for Navy midshipmen school are: Fred Leiderbach, former president; Royce Beckett, former vice president; Jack Harder, former treasurer; Richard Ball, Bob Fouts, and Al Weber.

The officers elected for the winter semester are:

Mike Martus .... *President*
Bob Hayes .... *Vice President*
Jerry Jenkins .... *Treasurer*
Jerry Davis .... *Secertary*
Dick Oberto .... *Corresponding Secretary*

Professor H. J. MacIntyre continues to be faculty adviser.

A.S.C.E.

The student branch of A.S.C.E. has embarked on what might be one of its most successful semesters. Its first meeting was held Wednesday, November 15, at 7:30 p. m. in room 319 Engineering hall and it proved to be a triumph for the society. David Tom, president, conducted the meeting and Mr. Peck, the club's adviser, introduced the members and the guests to the purposes of the society. After the friendly meeting was dismissed, cookies and cider added a pleasant finish to the evening.

This semester the A.S.C.E. is trying out a program that is going to be of ever increasing interest to its members. The plan of the revived club, as it now stands, is to meet once every two weeks. If fitting, these meetings will be on a Wednesday or Thursday evening at 7:30. At one of the two monthly gatherings, the A.S.C.E. will feature motion or slide pictures of such interesting engineering projects as the George Washington Bridge, the Holland Tunnel, the Chicago Subway and other constructions that will be of value for every engineer to know about. Accompanying these pictures will be an interesting lecturer who, with his comments, will make the film even more vivid than it already is.

At the other meeting, the society will feature a different type of entertaining knowledge; and it is certain that the members will find these gatherings beneficial to attend. All in all, the A.S.C.E. will have some very educational and profitable meetings for all those who attend. Refreshments will furnish a pleasing conclusion to most of the meetings this semester.

CHI EPSILON

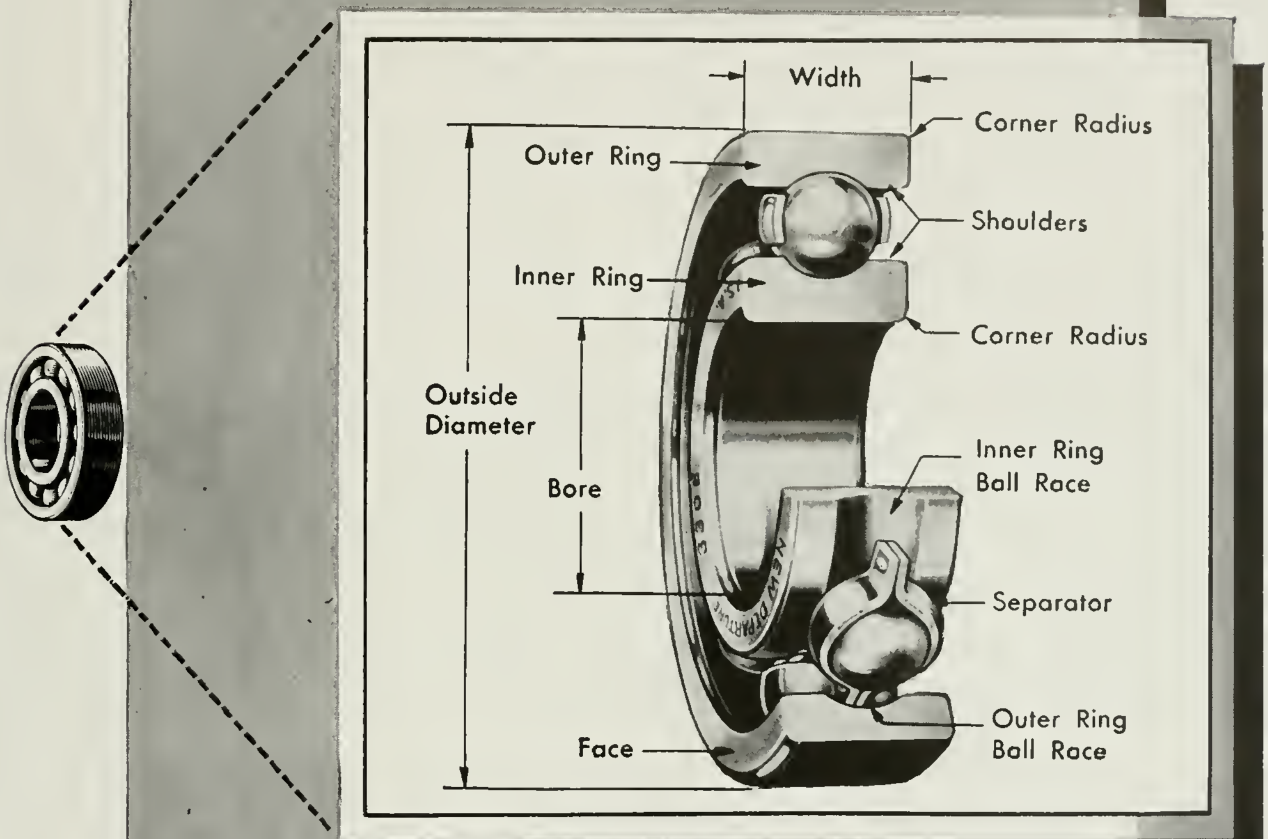
Chi Epsilon, National Civil Engineering Honorary, recently lost several members. Among the graduates were four V-12 students, Dave McCullough, Al Vanderwerff, Paul Monohan, and Wendell Wilson, who are at the Civil Engineers Midshipman School at Camp Endicott, Rhode Island, where they hope to receive their commissions and then go to the Seabees.

The results of the election for the fall-winter semester are:

William Frey .... *President*
Shelby Willis .... *Vice-President*
Boyd Paulson .... *Secretary*
Anthony Konstant .... *Treasurer*

Professor Oliver continues his position as faculty advisor.

Ever wonder about the anatomy of a Ball Bearing?



The subject of the Ball Bearing is on everyone's lips nowadays, because of its immense importance to the prosecution of the war.

But how many know what a ball bearing is—what it does—why it is so indispensable?

A ball bearing is not merely a steel ball! It consists of the assembled mechanism illustrated.

It is used wherever shafts turn, to support loads, to permit higher, smoother speeds. Because nothing rolls like a ball, it reduces friction and wear and assures that the precise "location" of machine parts is maintained.

To those who would know more about this "tremendous trifle" we offer free an interesting 112 page book entitled, "Why Anti-Friction Bearings?"

nothing rolls like a ball

NEW DEPARTURE

BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

Sales Branches: DETROIT, G.M. Bldg., *Trinity 2-4700* • CHICAGO, 230 N. Michigan Ave., *State 5454* • LOS ANGELES, 5035 Gifford Ave., *Kimball 7161*

A.I.E.E.

At the first meeting of this semester, an informal get-acquainted meeting, there were over seventy members present. Professor E. A. Reid explained the purpose of the organization, and Professor "Buck" Knight gave one of his usual short but interesting talks. Following this, future plans were discussed, the most important of which is the Electric Show to be given in Lincoln Hall Theater on December 6.

The officers for this semester are:

Dick Crawford .... *Chairman*
Curtis Donnel .... *Vice-Chairman*
Eddie Lyons .... *Secretary*
John Jeffries .... *Treasurer*

ETA KAPPA NU

During the last semester, eight men were initiated into Eta Kappa Nu, national electrical engineering fraternity. The new members are: John Budd, Don Delaney, Bob LaPlante, Eddie Lyons, Dick Medal, Paul Riepma, Harry Venema and Duane Watts. At the initiation banquet, Dr. Chell Mitcalf, the principal speaker of the evening, gave an extremely humorous talk on "Insects versus Entomologists." Professor "Buck" Knight was toastmaster; George Didinger gave the welcome, and Duane Watts gave the response. At present there are only seven active members on campus since many have left for Navy midshipman school.

New officers elected for the next term are:

Duane Watts .... *President*
Eddie Lyons .... *Vice President*
Bob LaPlante .... *Treasurer*
Paul Riepma .... *Secretary*

ENGINEERING HONORARIES HOLD FORMAL AFFAIR

Tau Beta Pi, in conjunction with Pi Tau Sigma, Chi Epsilon, Eta Kappa Nu, and Sigma Tau, presented a formal dinner and dance at the Urbana-Lincoln hotel last October 21. The occasion marked the close of the summer semester, which was to many members their last semester at the University of Illinois. The cuisine was excellent, the music enjoyable—a fine time was had by all.

PRE-WAR FACTORY

By Bert Levey

Although our standards of working and living are being rapidly changed by the war, there was a time, not too long ago, when the laboring conditions of a machinist were not nearly as dramatic and idealized as they are today. War jobs have acquainted many people with the existing state in machine shops. However, many of the modern machinists are not men who have followed with the trade from early development, but ones who have, most likely, stepped into their positions to help fill the need of a country at war. Moreover, many of the people who take part in the production in our factories are the efficient women of our nation. But even with the new enlightenment that this situation brings to the machinist trade, not even these people know what it is really like to spend a life time growing up working in the factory environment as it did prevail. However, by viewing the condition under which most machinists did work when the factory was just a place for a man to earn a living and not an "arsenal of democracy," you will conceive of what the working conditions were like for a man who spent his lifetime in a factory.

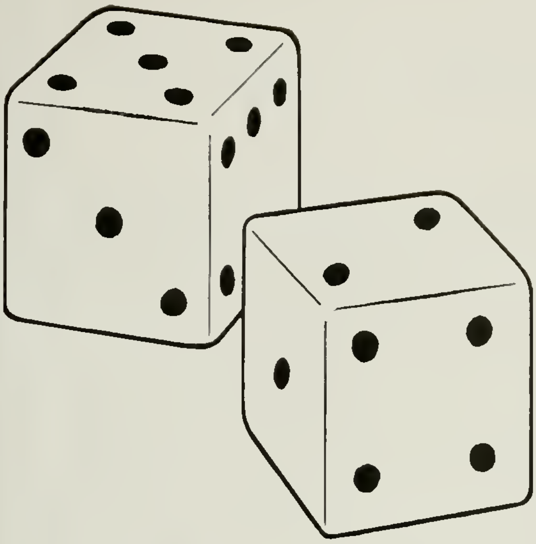
About the time of World War I, it wasn't unusual for a boy of sixteen or seventeen to leave high school prematurely and enter a factory as an apprentice. Many times it was the recognized duty for the older boys in a large family to go to work and contribute to the support of the family. It was in this way that a great many of our experienced machinists of today started.

The factory of those early days, and until a few years before World War II, was a dirty, unpleasant, and unhealthful environment in which to work. The floor was of uncovered concrete that was very tiring to the man's feet. The floor also proved to be a good conductor of heat and cold, and with the changes in the weather, the concrete radiated the same changes throughout the shop. In general, the factory wasn't properly illuminated, and on cloudy days the work benches were dismal places at which to work. The ventilation came entirely from the windows and open doors and if the weather wasn't suitable for comfortable working, there was little the men could do to correct it. The dust, grease, and dirt accumulations left their distinct marks all through the shop; for the men took little pains to clean anything except their own individual work benches and the machines at which they labored. And in most large shops, metal scrap and rubbish collected more rapidly than it was removed, even if an attempt at removal was made. The factory was an ideal breeding place for roaches and rodents, and the sight of big rats and crawling cockroaches was common.

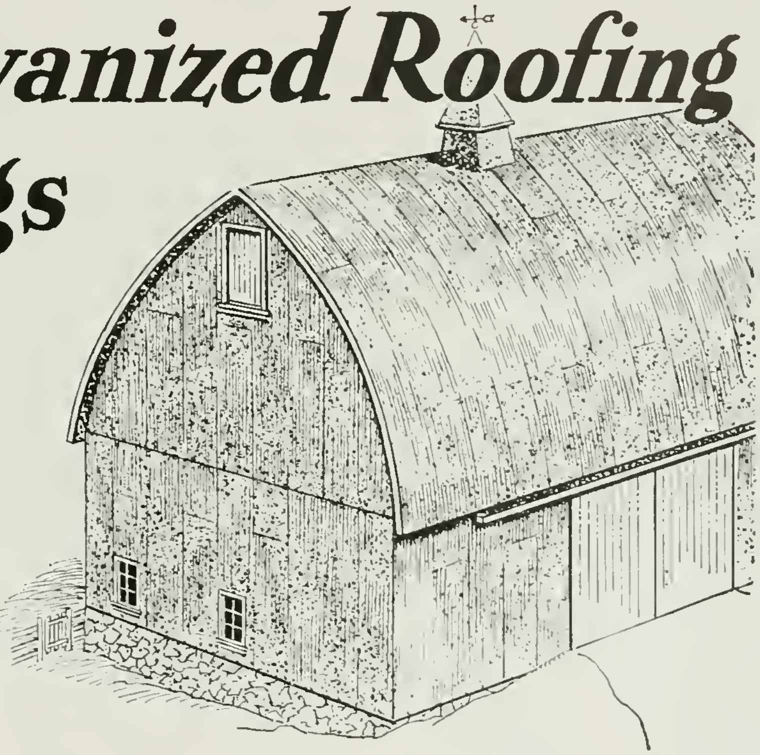
The employes were continually exposed to the hazards of the machines and often serious injuries resulted from the work. Much of the heavy lifting and moving of parts and machines had to be done without the use of electric hoisting devices. The chains in the early factory offered little safety protection to the workers; and the always-dangerous milling machines, lathes, drill and punch presses, circular wood saws, and high voltage equipment were constant threats to the safety of the employe. It wasn't an uncommon sight to see a man go running down an aisle to the first-aid station with four of the five fingers on one hand cut through and just hanging to his hand by a thread of skin. Gashes from flying chips, deep cuts from rough edged metal, and a crushed foot or hand were some of the common and prevalent injuries that made the men ever leery of the hazards that surrounded them in their every day work. Filings that became lodged in an eye were crudely removed by a fellow worker who clumsily fumbled about with his dirty hands and a magnet. Each accident was an impressive reminder to the men that their skill had to be so expert that it would overcome the dangers of the job.

Some of the conditions of the early factories were not so discouraging and disagreeable; for as the young apprentice became older and more experienced in his job, he became an artist of his trade. In those days the factories were not well equipped with precise measuring and cutting instruments and to do the fine work that is required of all machinists, precision and dexterity had to be learned by no other method than that of practice and experience. To work speedily and accurately to 1-10,000 of an inch, the accuracy that a great deal of machine work requires, is truely an art.

And so, with the installation of modern equipment, the increased protection of modern safety devices, the improvement of health and sanitation conditions, and the organizations of the men, the life of a machinist is no longer as hazardous and uncomfortable as it has been in the past.



It's GOOD LUCK to have Galvanized Roofing on Buildings



For in these days of material scarcities, galvanized roofing can be taken care of by simple, easy means and made to last a lifetime.

Galvanized roofing is zinc-coated roofing; and the U. S. Bureau of Standards states that zinc is "by far the best" protective metallic coating for iron or steel! Zinc in the form of galvanizing provides double protection:

First, by simple coverage, with a sheath of rust-resistant metal.

Second, by electro-chemical action or "sacrificial corrosion."

Galvanized roofing is used on more than a third of all the farm buildings in the United States — which proves that farmers are smart judges of roofing value!

Take Care Of It!

It's just good business to take good care of galvanized roofing. It is so easy to do it, too, that there's no excuse for neglect. With reasonable care, galvanized roofing can be made to give a lifetime of satisfactory service. Get a copy of the free booklet

"How to Make Galvanized Roofing Last Longer"

and the few simple steps to take will be made completely clear. The booklet is valuable. It's free—write for it today.

American Zinc Institute
INCORPORATED
60 East 42nd Street, New York 17, N.Y.

TECHNOCRACKS

One engineer to another: "Grab the end of that wire."
"All right."
"Feel anything."
"No."
"Well then, don't touch the one next to it, it's got over 5000 volts."

In spite of all the comment we still contend the ventilating engineer makes the best draftsman.

There was a young lady named Banker,
Who slept while the ship was at anchor,
But she awoke with dismay
When she heard the mate say,
"Now hoist up the sheet and spanker."

Counsel (to the police witness): "What if a man is on his hands and knees in the middle of the road, that does not prove he is drunk."

Policeman: "No sir, it does not. But this one was trying to roll up the yellow traffic line."

And the Germans named their ships after jokes so the English wouldn't see them.

"Were you excited when you first asked your husband for money?"

"Oh, no, I was calm and collected."

"Yes sir, as sure as I sit here now, I shot that old double-barrel in that flock of ducks and I brought down five of them."

"Didn't I ever tell you about my hunting frogs the other night? Fired once and 500 of them croaked."

Neighbor: "I like your radio. How many controls has it?"

Engineer: "Two. My wife and my daughter."

They arrived at the station loaded with luggage.

Husband: "I wish that we had brought the piano."

Wife: "Don't try to be funny."

Husband: "I'm not trying to be funny; I left the tickets on it."

Professor (to inquisitive student): "Do you know a dumb fool can ask more questions in ten minutes than a wise man can answer in ten days?"

Student (after a pause): "Professor, is that why I flunked my last exam?"

"Pa, what does it mean here by 'Diplomatic Phraseology?' "

"My son, if you tell a girl that time stands still while you gaze into her eyes, that's diplomacy. But if you tell her that her face would stop a clock, you're in for it."

Chemicals that protect your car!

HERE ARE THREE CHEMICALS that you are probably better acquainted with from the way they *act* as anti-freeze in your car than from the way they *look* in print.

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Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

TANKERS ON PARADE

IT would take 1,900 miles of tank cars to equal the capacity of all the tankers built since Pearl Harbor which are powered by General Electric propulsion equipment. At any rate, that was the figure through July of this year.

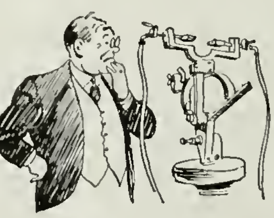
General Electric first built turbine electric drives for the Navy in 1909. Chief advantages then and now have been speed and efficiency. In wartime these are especially important. Tankers must move fast to keep up with the swiftest ships in the fleet, keep ahead of enemy subs, and utilize their carrying space fully.

General Electric is building three-quarters of the drives for the high-speed tankers ordered by the Maritime Commission since the United States entered the war. Speed of the 6,000-hp tankers is better than 15 knots, the 10,000-hp ones can do over 17 knots—both are considerably faster than a submerged submarine. The new high-speed tankers move fast enough and are sufficiently armed to run free on the long treks across the Atlantic and the Pacific. They no no longer wait for convoys.

DOUGHNUT MOTOR

IN the nose of some fighter planes, right in the middle of the motor that feathers the propeller, is a 37-mm cannon. Building a motor with a hole where the shaft ought to be was a brain twister, but G-E engineers solved this problem with an electric motor shaped like a doughnut.

The motor which automatically changes the angle of the propeller blades as flying conditions change has been designed with a hollow shaft. It is one of the many unusual motors that General Electric has designed and built to meet some specific need of America's fighting men.



BRAIN CHILD

ALMOST everyone likes to experiment now and then. It's fun, and in addition, worthwhile results are sometimes obtained. There is one machinist at the General Electric plant in Bridgeport whose experimenting brought real results recently.

The device shown above is his brain child. It may look a little grotesque, but it has proved very useful. A brazing fixture which can be rotated around three different axes, it has speeded up production on ignition parts for aircraft and earned a $750 cash suggestion award for the inventor. *General Electric Co., Schenectady, New York.*

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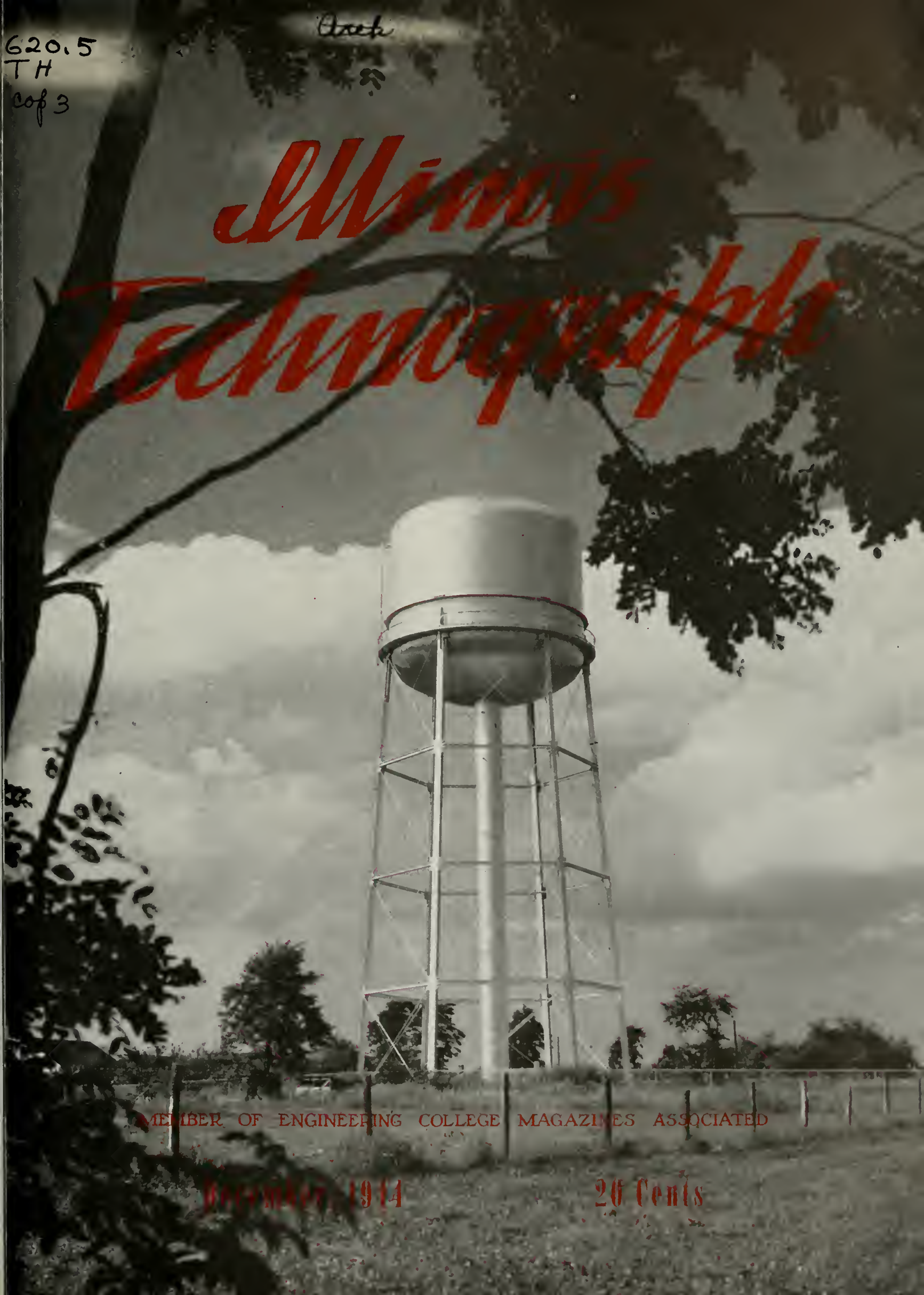
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MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED
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Illinois Technograph

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Our cover this month shows a large capacity gravity pressure water tank

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Illinois . . .
New Aero Department

By BERT J. LEVEY, C.E. '46, V-12

Headed by Professor Stillwell, one of the country's specialists in the field of aeronautical engineering, a Department of Aeronautical Engineering has been added to the curriculum of the University of Illinois. This course of study, for the first time offered in a separate department at the University, will not only be a great aid to the present war effort, but will provide the most modern methods of training for aeronautical engineering students who will help keep America foremost in the field of aviation in the peacetime years to come. The new department is just one small line in the blueprint for the University's large air transportation program. From the engineering standpoint alone, it would be exceedingly difficult to build and maintain aircraft without the knowledge of specialists in every field of engineering. Guided by its young, energetic, and visioned leader, this new department will prove to be one of the most beneficial and important pages written in the University's book of knowledge.

Of the entire program in aeronautics, the engineering branch is just a small core upon which the rest of the structure is built. It may be taken for granted that first there must be an airplane to fly before the rest of the industry that depends upon this fact can function. Then, as though it were the hub of a gigantic wheel with strong tieing spokes to every department in engineering and education, upon each of which it has some dependency for its strength and power to run, so lies this small hub of aeronautical engineering. At the University of Illinois itself, it can safely be said that there is not an educational department that is not looking with great interest to the part it can play in solving some of aviation's problems. From commerce, law, agriculture, medicine, and other fields, to the more closely connected brother engineering departments, there must be a strong bond of cooperation in order to develop the extensive air transportation program now being designed at the University. This new program, as it will be seen, is not connected with the airplane alone; but it is interlaced with these other branches of learning by the material that they furnish for the construction and operation of the aircraft. The airplane brings immense possibilities and consequently many problems, which make it necessary for these other departments to concern themselves and help write the specifications of the airplane and its operation.

Without the help of engineers in other fields, the life of an aeronautical engineer would be made quite miserable. If the plane designer didn't have the data and experience of the other departments of construction and design, he would be caused no end of delay and inconvenience. A great many of his problems are solved by the engineers in every field that can be mentioned. The mechanical engineer assists greatly in production and maintenance problems, and aids in the design of many vital parts of the airplane. At the University of Illinois right now, there are some of the leading men of the country in the field of synthetic rubber. They are conducting research to find a rubber that won't explode when brakes are applied to the wheels of a plane landing at one hundred miles an hour. What a tremendous thing it would be if that problem were solved for the aeronautical engineer! Civil engineers lend their data to the aeronautical men on the way different structures and frames act under widely varying loads. Electrical engineers have contributed instruments and electrical equipment which have made possible the development of the airplane as we know it today. The use of new materials and metals that are suitable for aircraft are directly handed over to the aeronautical engineer by chemists, chemical engineers, and metallurgists. To continue to show the important relationship and cooperation between aeronautical engineers and other fields would require many pages of writing and would be complete only with the listing of all the important functions of modern civilization.

However, don't form the conclusion that because the aeronautical engineer has important information from other departments to draw from that he has nothing left to do for himself for that, of course, is entirely incorrect! The problems of aerodynamics, design construction, production, maintenance, and hundreds of other questions involved in aeronautical engineering are as unlimited as the possibilities of the airplane itself.

The College of Law is faced with the rising problem of international air traffic. How simple can the laws for an air thoroughfare be to avoid accidents and international complications? The new regime of the airplane is causing more legal problems than did any of the means of surface transportation. The lack of precedent, in many instances, will make it necessary to carry on extensive research in legal procedure if the laws of the cities are to be sound and workable. In this connection, the College of Law can be of the greatest aid in helping to determine the requirements for the much-needed code.

A few of the other branches of education that are interested in this development of aeronautical engineering and its cooperative part in the whole scheme of air transportation can be briefly sighted. Commerce and agriculture will be interested in the rapid transportation afforded by the airplane. Flying will undoubtedly develop to the point where businessmen of this country can go to a distant nation to transact a day's business, doing their traveling by air at night, and be gone from their offices only one day. Absurd? Not at all! It can be done immediately after the war if schedules are provided. The developments for commerce that will result from aeronautical engineering are far more advanced than anything the average individual conceives. The speed and eventual economy of transporting the nation's produce by air will give agriculture a supporting hand that it never had thought possible before. This rapid means of transportation may also mean a great improvement in the health of a nation. Medical aid, travel, and mobility from inexcessible places will be of little consequence to the prowess of the airplane. Disaster due to flood, earthquake, or some other "act of God" could be more easily and quickly corrected because of the development of the airplane.

The various departments at Illinois will have the advantage of the finest and most modern college airport in the country from which they can conduct education and research programs. The University is bringing to completion a "class four" airport with three concrete runways 5,300 feet long and 150 feet wide, and one turf runway 4,000 feet long and 150 feet wide. It has 12,000 feet of taxiways which are 50 feet wide and are paved with concrete. At first, a smaller airport was contemplated, but the foresightedness of the government and the University led to the present plan so that a truly great air transportation program could be conducted at an institution where the facilities for education and research in the many phases of air transportation were available. It is possible that soon after the war, a Reserve Officers' Training Corps Aviation Unit will be established to correspond with other R.O.T.C. units. In addition to this possible program, there will be other flight programs conducted at the airport so that University students will have an opportunity to secure flight training under the safest and most efficient conditions. Psychological problems connected with flight are very important and present to this division of the University many new avenues of research and instruction. The psychological problems of high altitude flying are opening new fields of research, the results of which will greatly aid in improving the design of future aircraft. Courses dealing with this subject are also of growing importance since the family physician must be able to advise his flying patients of the effects atmospheric environment at altitudes may have on their physical conditions. This is just a brief resume of how the aeronautical engineering department is connected with other branches of education and industry. It should be stated that many of the departments of the University are now engaged in aeronautical education and research programs.

Perhaps it can now be seen that aeronautical engineering and aeronautics in general are not confined to the airplane alone, but are studies requiring the participation of many fields.

Professor Stillwell and members of the staff of the College of Engineering have designed an accredited 136 hour program for the engineer in the Aeronautical Engineering Department. The complete undergraduate course has gone before the proper University authorities and has been approvd. The engineer who graduates from this curriculum will not always be destined to be an aeronautical man as a result of too specialized training. He will have a background which will qualify him in the fundamentals in nearly any field of engineering he desires to enter. The aeronautics course will give its students a good basic engineering training with the program so designed that the student can apply fundamental principles to aeronautics. The curriculum is flexible enough to permit the student to elect some subjects that suit his particular interest, but it still guides him along the proper path to give him the training needed to become a good engineer and citizen. In the graduate program which hasn't been fully decided upon as yet, the student will be able to go into such specialties as aerodynamics, aircraft structural design, aircraft powerplant design, airline engineering, and aircraft production and maintenance. The program began on November 1, 1944, when five of the eight undergraduate semesters were put into operation. Each succeeding semester, one more new semester will be added to the young curriculum until all eight are in operation. There are now twenty-four students enrolled in the new department.

The plans that Professor Stillwell has for this growing department are far-sighted and invaluable to his students. Among these plans are some important laboratories in which the student will acquire a great deal of first-hand knowledge and practical experience. There are three laboratories that are immediately being taken into consideration. The first is an aerodynamics laboratory that will include a wind tunnel designed for student use. It is being developed on the promise that it will provide the best facilities for student laboratory investigation of aerodynamic principles. The design of the tunnel will make it possible for the student to work out all parts of the experiments from the basic problems to the actual testing with the instructor only giving help when needed. Unnecessary automatic devices which reduce student participation in experiments will be eliminated. The physical plant department of the University is now redesigning the old locomotive laboratory to accommodate the wind tunnel. Another of the three laboratories will be for aircraft physical testing. Professor Stillwell plans to have the necessary airplanes for the students to work with, all of which will be of varied design so that a useful knowledge may be acquired about the different types. In this laboratory, the student will study the action of aircraft structures, both small parts and major assemblies, under the application of static and dynamic loads. The third laboratory that the Professor has in mind is one for testing aircraft power plants. There will be many different types of engines that the student will become acquainted with through his laboratory instruction in the operating principles of aircraft engines. Professor Stillwell also has presented some studies of needed research laboratories to the University's Aviation Advisory Board and these needs are being considered. As time goes by, laboratories for studying and testing of aircraft accessories, electrical systems, hydraulic systems, and instruments will be made available to students. These laboratories, in which the student engineer will work, will be one of the most helpful and beneficial tools in his thorough training.

Professor Stillwell feels that the major developments in aircraft design lie in the future, and he wants his students to be prepared with the basic knowledge so necessary if they are to meet this great challenge. In addition to rotating wing aircraft, one of the big changes that will undoubtedly come about in the near future, is the utilization of gas turbines, jet propulsion, and rockets in place of the reciprocating gasoline engine. Many of these changes, not yet definite, but fast becoming a direct outgrowth of the war, must be taken into account when considering the University's educational and research program. The Professor is anxious for the University of Illinois to be a leader in this phase of aeronautical progress.

The meteorological rocket will be a typical peacetime product of the experimental phase of the utilization of the reaction principle for aircraft propulsion. The old method of studying meteorological conditions at altitudes by sending up balloons with suitable equipment attached is reasonably satisfactory for the lower altitudes. It is difficult to retrieve the instruments due to the drift of the balloon, but the low cost of this system somewhat offsets this disadvantage. The greatest objection to this method of observation is that the balloon will not ascend to a height great enough to provide data for the study of meteorological conditions at altitudes now becoming important for future airplane design consideration. Meteorological rockets, when they are perfected, may be fitted with meteorological instruments which will make it possible to study conditions that prevail at altitudes that far exceed the every-day conception of "high." Furthermore, such experiments will be of practical value in the development of rocket-propelled flight of all types. Power plants that are being considered for use in aircraft in the near future include the gas turbine driving the propeller directly, the combination of gas turbine driven propeller and jet propulsion without the use of a propeller. Each of these new power plants will influence aeronautical engineering, and the student will not be deprived of the chance to study these new developments.

Perhaps from reading the many possibilities for research and development in the aeronautical field, the student may acquire the idea that it would be a simple matter for anyone to make a success in this phase of engineering and industry.

(*Continued on Page* 18)

HEAD OF . . .

By BERT J. LEVEY, C.E. '46, V-12

New Aero Department

It is very seldom that any man accomplishes in a lifetime what Henry Stillwell has done in less than twenty-seven years. Professor Stillwell, educated at two of the country's outstanding universities and employed by some of the major aircraft corporations in the country, now comes to the University of Illinois as head of the Department of Aeronautical Engineering.

Professor Stillwell is well suited for the position he holds in the new department, for the field of aeronautics is young and the men in it are equally young. With his wealth of experience in teaching, research, construction, and design, Professor Stillwell has gathered a rich knowledge to carry out the task required by the Aeronautical Engineering Department. His ideas are broad and advanced, yet his system of training for the aeronautical engineer is practical and well defined. His plans are foresighted in that they take into account the newest developments that are taking place in aircraft transportation at this time and the major changes that will come into the field of aeronautical engineering.

Professor Stillwell spent most of his early life in Kansas City and Independence, Missouri, where he attended high school and upon graduation went to the University of Minnesota. He had always had the "flying bug," and Minnesota gave him his first specialized training. In 1939 he graduated with honors from the College of Engineering. His work was of such a high caliber that he was given a research fellowship at Minnesota. Professor Stillwell accepted and remained at Minnesota for a year, solving research problems in the structural branch of aeronautical engineering. Then he changed his capacity and taught aeronautics for the next two years. In 1942 he left Minnesota to become Head of the Department of Aeronautical Engineering at the University of Kansas, where he remained until coming to the University of Illinois, November 1, 1944, in the same capacity.

Professor Stillwell did most of his graduate study at the University of Minnesota, and he received his master's degree in 1940. He now is well on his way to obtaining his Ph.D. degree. During his time of study and of practical experience, he has written many technical papers, of which two have been published by the Journal of Aeronautical Sciences and two by the University of Minnesota. One of these papers was his thesis: "The Bending Strength of Certain Thin-Walled Stainless Steel Sections."

It may seem that with all the education to which he was exposed he would have little time for anything else. But this is not the case, for in the summer he worked with some of the leading aircraft corporations in America. Tipton Aircraft Corporation, San Diego, and Vought-Sikorsky Aircraft Company, Stratford, Connecticut, employed the services of Professor Stillwell at one time or another. His main capacity while working for these companies was in solving research problems and supervising the practical training of other employees.

Much of the work that Professor Stillwell has done has been on aircraft for the United States government. He was engaged on many of the pioneer jobs that had to be undertaken. He helped solve many of the problems con-

PROFESSOR STILLWELL

nected with the four-engine patrol bomber, PKX2Y2, experimental torpedo bombers, scouting planes, observation aircraft, and other questions dealing with the speedy fighter planes. He has also worked on the solution of glider problems, which are entirely apart from those of a power driven aircraft, and other questions dealing with the speedy fighter planes.

If you chanced to pass Professor Stillwell while walking down the street, you would probably think that he was another student rather than the leading man in the University's new department. Professor Stillwell is five feet, ten inches tall and weighs 160 pounds. His walk is quick and sure, that of one who knows what he wants to do and sets out to do it. A seriousness rests in his deep set eyes that is sometimes hidden by the light reflecting from his glasses; but the sincere, earnest tone of his distinct and flowing conversation is never mistakable. His pipe clenched between his teeth and his hair parted deep on the left side of his head add a touch of casualness to his dignified bearing. And only if someone pointed him out to you could you tell that this man of smooth dress, young countenance, and valuable experience was not a student but a professor and an outstanding man.

Although it may appear as though he has done little else in life except advance the progress of aeronautics, he has other diversions and hobbies. Whenever Professor Stillwell has a little spare time, it is usually spent flying. He has a private pilot's license. He also enjoys playing tennis and basketball, and he likes to swim. However, his wife and twenty-two month old daughter, Pamela, retain the professor's greatest interest in life.

This is only the first twenty-seven years of the life of the man who comes to head the Department of Aeronautical Engineering; one of the outstanding men of the country, one of the most prominent and highly esteemed men in his field.

VALUABLE SEA WATER

By AUDREY GOLDMAN

It is remarkable that the first chemical exploration of sea water was not until the end of the eighteenth century. For water, which has been discovered to contain virtually every known element, has been such a dominant factor in the development of civilization. However, the first *comprehensive* quantitative analyses of sea water were made in 1884 by Dittmar, who listed more than thirty elements.

Theories as to how these elements came to be present are varied. The most common is that they have been washed down by the rivers over millions of centuries and that this steady process of washing away the land into a tremendous evaporating basin has concentrated these elements to a point where they are discernable and some reclaimable. The other outstanding hypothesis is that the ocean has always been "salt," acquiring its chemical composition from volcanic gases at the time that the earth's crust cooled and clouds of vapor condensed to form water.

From Dittmar's analyses one extremely important fact was proved—that the composition of sea water is essentially constant all over the world. For practical purposes it is considered to contain the elements chlorine, sodium, magnesium, calcium, potassium, bromine, boron, and flourine—chiefly in the form of various soluble salts. Until very recently, however, few attempts had been made to extract any of the ocean's chemical elements and compounds, with the exception of common salt.

BROMINE PLANT

From the earliest times, the extraction of sodium chloride from ocean water has been accomplishd mainly through solar evaporation. Evaporation by direct heat has been successfully utilized, but the great bulk of the world's sea water salt industry is concentrated in geographic areas where climatic conditions are favorable to solar evaporation. Refinements of process have been developed, but the basic principle remains the same—letting ocean water into broad, shallow basins where the water gradually evaporates from the sun's rays until the salt crystalizes and is deposited on the floor of the basin. While this solar evaporation for salt has been going on for centuries, the use of the Bitterns from this process for further chemical reduction is comparatively new. This concentrated liquor from the salt beds is used for the production of bromine, magnesium chloride, hydroxide and oxide, and calcium sulfate or gypsum. It is not economically feasible, however, to use this method of extraction for these products alone.

The two most notable phases of sea water chemistry in recent years are the extratcion of pure bromine and magnesium metal by direct chemical process from raw ocean water.

In 1924 appeared a new development in the chemistry of sea water—an attempt to reclaim commercial quantities of an element directly from the sea entirely by chemical process. Tetraethyl lead, used in motor fuels to prevent "knock," fouled spark plugs, valves, and piston rings when used alone. It was found that this difficulty could be eliminated by adding a small amount of ethylene dibromide to the mixture. At that time the country's production was inadequate to meet the demand. This demand forced chemists to look for new sources of bromine.

SEA WATER INTAKE

Bromine is found in sea water to the extent of less than seventy parts per million, yet this source was considered because it represented an inexhaustible supply.

The first method tried involved the addition of amoline to chlorinated sea water, which yielded tribromoanilene—applicable for the motor fuel treatment—with sodium chloride and hydrochloric acid as by-products, was a failure. A new process was then developed which consisted essentially of oxidizing the brine with chlorine to liberate the bromine, blowing the free bromine out of solution with air, and absorbing the bromine from the air with an alkali carbonate solution from which it was subsequently recovered in a commercially desirable form.

Because of the slight alkalinity of sea water, it was first found necessary to add sulphuric acid, as well as chlorine, to the raw material to increase the hydrogen ion concentration of sea water since the pH factor was discovered to be of major importance in the process. Decreasing the pH also decreased greatly the amount of chlorine required per pound bromine recovered. Thus acid was the real key to successful bromine extraction. After this, other modifica-

(*Continued on Page 24*)

Architectural Engineering

By AUDREY GOLDMAN

Architecture is one of the world's oldest professions; but the combination of architect-engineer is comparatively new.

The first course in architectural engineering—the first of its kind in the country—was introduced by Dr. Nathan Clifford Ricker, dean of the College of Engineering from 1878-1906, at the University of Illinois in 1890. The need for architctural engineers was first emphasized to Dr. Ricker when a prominent Chicago architect first decided to build a theater, above which would be a tall building. As the theater would have no supporting columns, the question of how the building was to be supported was too ticklish for the engineers, and none would undertake the job. Upon being approached with the architect's problem, Dean Ricker first conceived the idea of teaching to engineers the structural phase of architecture and of giving them an appreciation of the architectural side.

FINE AND APPLIED ARTS BUILDING

It became evident to him that few men were very competent in both design and mathematical studies, and some in neither, but that most students could be divided into two classes, good in one or the other, but not in both kinds of studies.

Most architects are either ignorant of higher mathematics or never have occasion to use them in their practice—nothing more than arithmetic, a little algebra, and considerable projection and descriptive geometry. It therefore seemed a waste of effort to compel all the promising students in design to struggle through higher mathematics and mechanics in order to see dimly the origin of formulas in strength of materials. Particularly when architects generally depended on rule of thumb formulas for dimensions or guesswork, and as a last resort only—consulting engineers.

Therefore, the idea occured to the dean that, since students lacking design might be made competent constructors,

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provision should be made for them by establishment of a new four year course for architectural engineers, preparing those students to solve the ever novel and frequently difficult problems found in every new building, with a great advantage over civil engineers in possessing a full knowledge of architectural construction.

Opening for architectural engineers are unlimited. As engineers ar now coming to appreciate the work of the architect and, conversely, the architect is beginning to appreciate that of the engineer, engineering of a sounder character is being brought into our architectural structures and more architectural merit into buildings which are now neglected. The types of engineering involved with architecture for the coming reconstruction program are foundation engineering, structural engineering—including concrete masonry, steel, and timber—heating and ventilating, electrical works, and sanitation.

The architectural engineering course offers a major study in building design from the standpoint of safety and economy. It provides a thorough training in all forms of building construction and emphasizes the structural and

(*Continued on Page 20*)

OUTSTANDING *architect*

By HENRY J. KLUCK, Arch. E. '45, V-12

There is significance in the fact that Professor Provine says, "Life is exciting—every moment of it!"—for that tremorous statement is indicative of the full and productive life which he is leading, and the scope of understanding which he has an an educator. Here is a man who maintains faith in the good and beautiful—with an eye on human frailties—a man who finds great satisfaction in having brought personal philosophy and duty into full accord.

Only consideration for Professor Provine's modesty prevents paralleling his rise to his present responsible position as Head of the Department of Architecture of the University of Illinois with stories of Americans who, through their own initiative and skill, become progressive leaders in their fields of endeavor. Suffice it to say that Professor Provine's beginnings in life were humble when viewed economically, but that his home offered more substantial metal, material from which a young man could fashion an independent mind and a growing philosophy which would last throughout life. Quincy, Illinois, offered no architectural marvels to catch a young man's fancy, yet, somehow, before the pen of memory began recording, it was decided that he should be an architect; for Professor Provine cannot remember the time when he did not so dream and plan.

Independence and forthright began reaping their rewards when Professor Provine entered the University of Illinois largely under his own "power." Those were the beginning days for study of architecture as a profession, when the department at the University of Illinois occupied a corner of Engineering Hall and struggled along on a mere pittance for expenses; the days when social fraternities were practically non-existent, when students were generally older and more serious, and when professors, who were paid by lecture fees, were reluctant to divulge any more information about their fields than the student could gather in lectures. There was great inspiration, though, and ever growing excited interest in Dr. Nathan C. Ricker, then Head of the Department of Architecture, who championed the architectural profession in its beginning agonies with fortitude and foresight. This was the atmosphere in which Professor Provine worked toward his degree in architecture, molding and re-molding his conceptions of a grand profession awakening on the threshold of a new era, and ever more determined to meet its challenge.

How well the challenge was to be met was soon seen when Professor Provine tucked his B.S. degree in architecture under his arm and set out into the field of practical application of his studies in 1903. The intervening years until 1913 were busy and productive in practice with time out from 1908 to 1909 to return to the University of Illinois to win an A.E. degree in architectural engineering—which branch of the profession Professor Provine found more to his liking. During those years, he worked on designing, estimating, and supervising construction of commercial buildings, industrial plants, and steam and hydroelectric stations. Particularly noteworthy among his assignments being the preliminary designing and estimating for the Keokuk, Iowa, power house; and designing and supervising of construction of buildings for the hydro-electric Big Creek development for the Pacific Light and Power Company of Los Angeles. The latter work was a tremendous undertaking; for at that time Big Creek development had the highest head of water and the longest transmission line in the country, and involved simultaneous designing and overseeing of construction of two 120 foot power stations, two switching stations, and twelve patrolmen's cottages along the 212 miles of line. Since high voltages were largely experimental at the time, considerable ingenuity had to be used in handling them and devising safe insulators at building line entrances to handle the 150,000 volts. Thus in the ten years following his graduation from the University of Illinois, Professor Provine had finished work which could have been a lifelong ambition without the fortitude and stamina of a man who thrilled and responded to the challenge which architecture offered.

In 1913, there came a call from the University of Illinois for Professor Provine to return to his alma mater as Head of the Department of Architecture, to build up the department which had at last come into its own right through the sincere and tireless efforts of Dr. Ricker, who preceded Professor Provine as head of the department. Throughout the years, Professor Provine has fostered the growth and progression of the department, nobly carrying on the work which his predecessor had begun. He has maintained the well-grounded academic training, knowing from practical experience an architect's requirements; has ever watched the present and future to keep the curriculum abreast of the changes in practice; and has faithfully continued the fine work which Dr. Ricker had begun with the Architecture Library, to keep it one of the most outstanding in the country. Professor Provine has not allowed the department to be swayed by momentary fads and fancies, but rather has placed emphasis upon the more fundamental aesthetic solutions of problems with a basic understanding of materials and construction. Through such understanding leadership, the University of Illinois has retained its position as one of the finest schools of architecture in the country, winning the University Medal of the Societe des Architectes Diplomes par le Gouvernement Francais in 1929 and 1942 for the best record of accomplishment in the teaching of architecture.

Aside from his regular executive work, Professor Provine has always been active on boards and committees of a civic or research nature, having organized and served as director of the first Fire College to be held in this country, and just recently having completed complete rewriting of the Building Code of the National Board of Fire Underwriters.

This record of architectural, educational, and public-spirited work is by no means complete for a man who says, "Life is exciting!" Professor Provine looks to the future with sparkling eyes, anticipating more work and more services; hopefully planning special courses for returning veterans interested in architecture, and refresher courses for architects whose professions were interrupted by military service; fostering research in low-cost housing to meet demands after the war; and ever carrying out the great work of preparing young architects technically, aesthetically, and ethically to meet the demands of the building world.

PERSONALITIES . . . *on the campus*

JAMES C. WOOD

Jim comes to our campus from Wilmington, Illinois, and is scheduled to complete his course in Civil Engineering in June, 1945. His plans for the future are rather indefinite, but he is looking tentatively to graduate work followed by a career in the structural field.

From the scholastic point of view this man seems to be doing well. His all-University average stands at 4.12, and he is a member of Chi Epsilon, national honorary civil engineering fraternity. He was secretary last year, and is now treasurer of the organization. Last semester Jim was secretary of the student branch of the American Society of Civil Engineers.

This lad has shown considerable interest in extra-curricular activities. His specialty is dramatics. Last year he played the male lead, David, in the Illini Theater Guild production of "Claudia." At present, he is rehearsing for the part of Benoolio in Shakespeare's "Romeo and Juliet." He is frequently to be found around the Lincoln Hall theater and his value is evidenced by his membership in Pierots, men's dramatic organization.

As a further evidence of his well-rounded life, we might mention that Jim was a baritone in the University Men's Glee Club last year, and was a member of the Freshman rifle squad during his first year on campus.

In high school, Jim was interested in debating and in individual oratory, going to the state speech contest in his senior year. Although he was a football letterman in high school, he gets in only an occasional Saturday afternoon game nowadays.

Jim seems to like Illinois. For he has said: "After visiting other campuses in the East and South I can say that I have yet to see a campus more interesting or more beautiful than ours."

☆ ☆ ☆

WILLIAM MEID

A senior we can't afford to miss is William Meid. Bill is one of those rarites—a Ceramic Engineer. There are but two V-12's out of some 68 thousand that are enrolled in a Ceramic Curricula. Bill, as a V-12, is an old-timer, having been in this unit since its founding in July, 1943. During this time, he has held almost every "rank" in his company—at the present time is is Company Commander.

For a person to enter a field like ceramic engineering, there has to be a good reason—Bill has that reason. His home is in Kohler, Wisconsin, where the Kohler Company, the largest sanitary ware factory in the country, is located. Bill's father is an employee of the company and, during several pre-war summers, Bill himself worked there. In high school, Bill Meid (properly pronounced "Mide," but to all here at Illinois, "Mead") was an outstanding student in scholarship, music, and athletics. The Kohler Company thought that Bill showed promise, so they gave him a four year college scholarship in Ceramics. He was originally enrolled in Ceramics, but upon entering the Navy he transferred to Ceramic Engineering.

Bill's college career thus far has proved that the Kahler Company knew how to pick a good man. His grades showed him to be an excellent student. He was a member of both the varsity track and varsity basketball squads last season. As a freshman, he played in the Concert Band—everybody who ever lived near Bill's room in Busey Hall remembers how he used to coax his clarinet through Rhapsody in Blue or The Flight of the Bumble Bee. Bill has made the Kohler's nod their heads and say "I told you so" more than once—the last time being when he was elected president of the American Ceramic Society.

All work and no play makes Jack a dull boy, but no one can say that Bill is a dull boy. His three favorite hobbies (not listed in any special order) are duck hunting, visiting a "friend" at the Alpha Delta Pi house (—the "friend," by the way, has his Delta Tau Delta pin), and taking money from his best friends who play that card game, Sheephead.

Bill's plans for the future are not too definite. He hopes, of course, for Midshipman's School and a commission next summer. After the war, he plans to enter the field of white ware or sanitary ware.

☆ ☆ ☆

RICHARD J. MEDAL

Dick is one of the members of the civilian graduating class of June, 1945, in the Electrical Engineering Department. Recently he married Martha Anne Burnham of Industry, Illinois, a Home Economics major. Dick, himself, claims Chicago as his home town.

This fellow has excellent grades. His average was over 4.5 on the last checkup and he is a member of the Tau Beta Pi and Sigma Tau engineering honoraries, as well as Eta Kappa Nu, scholastic honorary in Electrical Engineering. He belongs to the Institute of Radio Engineers and the campus branch of the American Institute of Electrical Engineers.

Dick sang in the University Glee Club last year and says he likes to listen to good music. He enjoys anything connected with radio, which is his chief hobby. After finishing school, he plans to engage in electronic research work in industry.

Outside work has always been interesting to this man. At present he is working in the Cyclotron laboratory with the Physics Department and the Instrument Calibration laboratory of the Electrical Engineering Department.

Dick says he likes the E.E. Department equipment and faculty and is an admirer of Professor Knight, acting department head.

ROBOTS . . .

By WILLIAM GUYTON

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Robot! The very term sets the imagination to work, and evokes scenes in which giant monsters are killing off hordes of people, blood is flowing in streams around the wreckage of buildings, and women and children are running helplessly to and fro. For many centuries, almost from the time of his creation, man has been fascinated by the thought of mechanical men—men who would faithfully perform any task to which they were assigned. Writers of every century, recognizing the almost universal appeal of robots, have seized upon the subject, and have woven fantastic tales like R. U. R., a play in which robots, made in semblance of men, rise up in rebellion and destroy their human masters. Such literature has led to the belief that the robot is a horrible, fearful enemy of civlization. No such inference, however, could be drawn from the term itself, for the word, "robot," comes from the Czech word *robit*, which means *to work*. Robots are nothing more than automatic machines which do the work of men, and only by association with such preposterous writings has the term come to its present usage. Fiction writers make a curious mistake about the robots. Always these are imagined as distorted images of humanity; gigantic, horrible monstrosities like store window dummies full of mechanical brains. Real robots are not like that.

Considering robots for what they really are, we find that they play a very significant part in our modern world. A more plausible reason for skepticism about robots than fear of their power would be their effect upon labor. Who has not heard the uninformed, or the misinformed, radical blame the "machine age for our present depression? In many industries, automatic machines, which are robots, according to our definition, are doing the work of many men. These robots are indispensable aids to our modern civilization. They create; they do not destroy. Can you imagine the modern daily newspapers, with their large circulation, printed one at a time by hand? Yet no one ever stops to think that it is a gigantic robot, working tirelessly, which makes the daily newspaper possible. Or can you conceive of the modern housewife sitting at home and weaving or knitting so that her family will have clothes to wear?

Many robots have been developed which seem to display almost superhuman abilities. Some have such sensitive "palates" that they can test chemicals accurately by "taste." The Product Integraph is able in a few hours to solve correctly difficult differential equations which would take weeks if worked mathematically. And, impossible though it may seem, this robot can perform calculations beyond the power of the human brain. In Washington, the "Great Brass Brain" predicts ocean tides with astounding accuracy. Giant ocean vessels have been guided and operated solely by the gyroscope, with another robot, the fathometer, making automatic soundings every minute.

Countless examples of robots upon which we are dependent for our everyday convenience could be cited. Who operates the many traffic lights of a large city? A robot. Who connects you with your party when you dial a number on your telephone? A robot. Why do street lights come on when it grows dark, and go off when it again gets light? Because a robot has been actuated by the degree of light reaching its eye, a photo-electric cell. With an almost inaudible "clock," issuing from a little gadget of a wall, an infallible robot, which controls the temperature, humidity, and circulation of an entire building, is commanded to begin operations.

But such robots, though they are mechanical men, are not of universal interest. The robots which attract the most attention are those built in the likeness of living creatures. Life seems to be the one thing which science cannot explain, and any attempt, therefore, to create a lifelike robot holds the interest of human beings everywhere. A very captivating example of such a lifelike robot was the mechanical cow developed for the "Century of Progress" in Chicago. It was designed to imitate accurately all the actions of a real cow. "The sides of the mechanical cow move in and out in regular rhythm to simulate breathing. This mechanical cow "gave" milk, an automatic milker, a robot in itself, drawing milk from the udders in a continuous stream. "The head sways, the eyes blink, the ears move lazily and the jaws go through the process of cud chewing. The tail swings from side to side, and at intervals gives a vicious switch." Inside

(Continued on Page 18)

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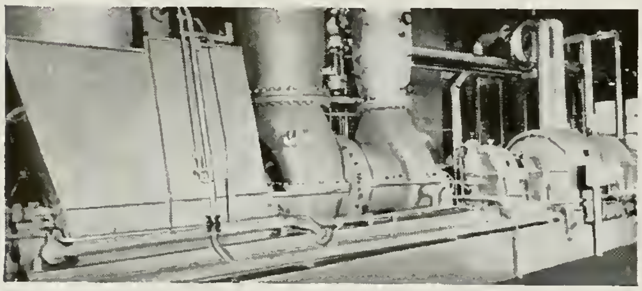

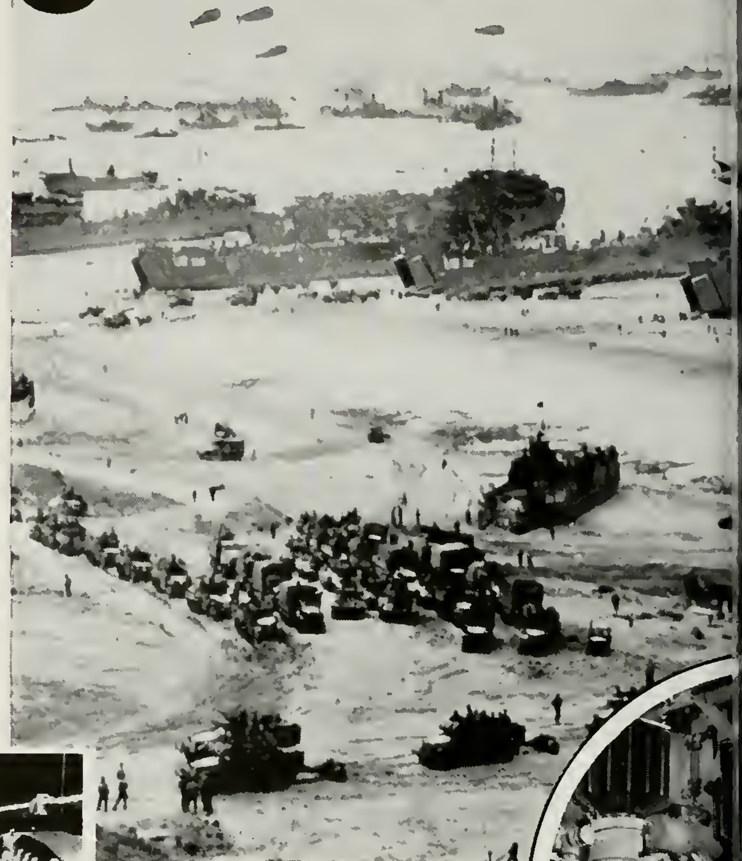

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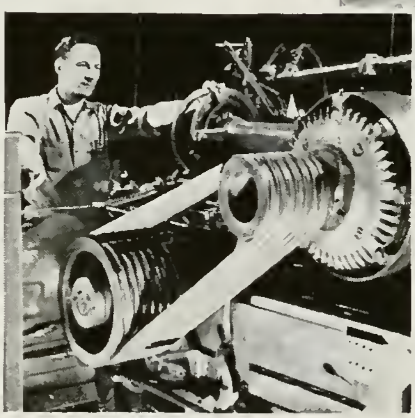

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VICTORY NEWS

New "Streambarker" for Paper and Pulp Mills. First hydraulic barker ever designed for standardized production. Allis-Chalmers' new Streambarker not only eliminates hand cleaning of pulpwood logs but saves man-hours and money for mill operators by completely eliminating pulp loss from "broomed" log end.

Secret is water under 650 pounds pressure which removes bark as logs are revolved and propelled through the Streambarker. It handles logs 4 to 8 feet long, 4 to 10 inches in diameter. Write for Bulletin B-6341.

Hunting Defects is His Business! The man above is giving A-C motor shafts the "eagle eye." It's true he doesn't find many defects. But none that are there get by him!

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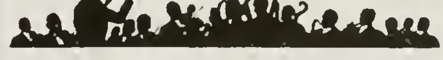

BLUE NETWORK—COAST-TO-COAST

ROBOTS . . .

(*Continued from Page 15*)

the cow, two small motors controlled the movements of the entire animal. The "udders" were supplied with milk by a large tank, and, unseen by the spectators, the milk was pumped back into the tank from the milker through a pipe in the animal's hind leg.

By far the most interesting of the recently developed robots, however, was the televox, designed by R. J. Wensley. Before the development of the televox, many automatons in human form had been constructed, and "as early as the Middle Ages, Albertus Magnus made automatons in human form which could open doors and play musical instruments." But the televox was the first robot which could respond to a telephone call. It was originally developed to operate electric substations where the cost of stationing an operator seemed to be prohibitive. The televox, having been put in charge of the station, could be called up on an ordinary telephone, and commanded by an operator thousands of miles away.The telephone instruments employed are not in the ordinary way altered and may be used in the ordinary way whenever wanted; distance is no barrier to the operator of the televocal system.

Let us suppose that we are an operator calling up Mr. Televox to inquire about the condition of his substation. We pick up the telephone and call his number. On the other end of the line, Mr. Televox's Mechanical hand lifts the receiver from the hook and he says, "Buzz-zz-zz," which means "Mr. Televox speaking."

Desiring to know the height of the water in the reservoir, we say, "Peep, peep, peep, peep, peep, peep?"

"Buzz, buzz, buzz, buzz, buzz," which means, "there is twelve feet of water in the reservoir."

Deciding that that is all right, we say, "Peep," which means, "O. K. So long."

Mr. Televox hangs up, and our conversation is over. As you have noticed, the televocal system is not commanded by words, but by tones. There are three tones which are used, a high-pitched tone, a low-pitched tone, and an intermediate tone. By various combinations of these tones, the televox is operated. "The sounds, when received by the televocal apparatus, are passed through filters so that all but exactly the selected pitches are eliminated and extraneous noises are prevented from causing operation of the relays."

Gradually, more for amusement than for practical use, modifications of the televox have been developed. "The Westinghouse engineers in their laboratory have refined the televox to such a degree that it will open a heavy door in the vocal call of 'Open, Sesame' and to no other sound or sequence of sounds." Some have been built in human form, and can do little odd jobs like ringing a bell, turning on a fan, answering a telephone, firing a furnace, lighting an oven, or raising a flag. "Some robots 'understand English'; they can respond to simple vocal commands like 'Stop!' 'Reverse!' 'Go ahead!' but care must be taken to use the actual words arranged for, and not their synonyms. For example, if you used the word 'Proceed!' instead of 'Go Ahead!' the robot might mistake the two-syllable word for 'Reverse!' But if you used the code agreed upon, whether voice or system of whistles, the robot is infallible."

Perhaps in the future, robots will be of more use than they are at the present time. The development of the televox has opened an unlimited field for research. "So far this particular device has only been unsed with land telephone lines, but it could easily be adapted to radio." The future development of these mechanical men should prove very interesting.

NEW AERO . . .

(*Continued from Page 9*)

This idea, of course, is not true. The field is young, the men in it are also young, and consequently, the personnel turnover is not great. But as in anything else, there is great possibilities for the man who has the desire and ability to produce the ideas needed in this highly scientific field. The opportunity is there, but the young engineer must be interested in the field and willing to work hard if he is to be successful. Aeronautics, as everything else, has no "royal road to success;" and it is the young, vigorous, persevering engineer who will take the lead in this new industry.

The new Department of Aeronautical Engineering at the University of Illinois offers its students one of the finest opportunities in this field that can be found anywhere. Under the excellent supervision of Professor Stillwell, the graduate student will be a competent, efficient engineer, well versed in the basic fundamentals of his profession; and he will be an engineer who will be a credit to himself and to his country.

She stroked my hair; she held my hand.
The lights were dim and low.
She raised her eyes with sweet surprise,
And softly whispered, "No."

"It's easy to write a play. First act, boy meets girl. Second act, they hold hands. Third act, they kiss."

"That's how I got arrested."

"What do you mean?"

"I wrote a five-act play."

ARCHITECTURAL ENGINEERING . . .

(*Continued from Page* 12)

mechanical aspects of architecture. As the curriculum includes two years of architectural design, free-hand drawing, and the history of architecture, the student who is primarily interested in construction can acquire a considerable knowledge of the artistic and utilitarian phase of planning. Such courses provide him with a means of expression, a tool to work with—for the architectural engineer must be able to sketch his ideas. This option affords a relatively wide range

DRAFTING ROOM

of elective courses in the social sciences, business, engineering, language, and literature. It also provides sufficient training for independent practice as an architectural engineer.

After his freshman year—the curriculum of which is the same as the architecture curriculum—the architectural engineer branches out on his own, and his curriculum for the following three years includes history of architecture, architectural design, free-hand drawing, diffrential calculus, analytical mechanics, technology of materials, graphic statics, steel construction, reinforced concrete theory, building sanitation, building lighting and wiring, mechanical equipment of buildings, and so on.

The college itself is splendidly equipped. The Architecture Building houses the Hall of Casts, galleries, studios, drafting rooms, lecture halls, and the famous Ricker Library—all these form portions of a physical plant for teaching the Fine and Applied Arts which is not excelled in America.

The Hall of Casts, with its plaster reproductions of century-famed sculptures, is used as a classroom where the architectural engineering students study the construction of the various cornices and friezes, learning what must go behind them in order to support them. Here they learn what has been done in the past. The drafting rooms are occupied by students of both architecture and architectural engineering working together.

The selection and collection of the books in the Ricker Library, which occupies the entire area of the north wing of the building, took almost thirty years. The books were chosen with special reference to the needs of the students and instructors, until it is now said to be the best in the country for its purpose and also the most widely used. It is the heart of the department of architecture.

The architectural engineering graduates of the University of Illinois have been eminently successful, some of them entering practice as architects of buildings chiefly structural, while others have done good service as engineers in offices of large firms of architects, or as consulting engineers.

OUT OF TUNE

Nervous Musician: "Madam, your cat has kept us awake two nights with its serenade."

Mrs. Nextdoor (tartly): "What do you want me to do, shoot the cat?"

Nervous Musician: "No, madam, but couldn't you have him tuned?"

* * * *

"How long are you gonna be in that bath-tub?"
"Same length I am any place else, ya' sap."

* * * *

There is the story of the gentleman visiting in Washington, but who wanted to phone someone in Baltimore. It proved annoying when the operator said, "Deposit twenty-five cents, please." "What!" he cried. Twenty-five cents to call Baltimore? Why, at home we can phone to hell and back for a nickel."

"Oh, yes," she replied. "But that's a local call."

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The Technical Term 'M'

The letter *M*, when placed in a series, one *M* closely following another, can be used to voice approval—"mmmmmmm, my dear"—or can be used to ask a question—"mmmmmmm?"—or used to voice disapproval—"mmmm mmmmmm!" The letter *M* is a handy alphabetical gadget. It can replace *mother*: $m = mother$. It can replace *million*: *M* is for the millions of times I've kissed you. *O* is for . . .

In physics, chemistry, and mathematics, *m* is used extensively as a replacing agent for, they say, purposes of simplification. In physics, for example, *M* stands for *mass*. Mass is the weight of a body, *W*, divided by the acceleration of gravity, *g*. Therefore, if one wishes to express that definition simply, one writes $M = w/g$. That appears to be a very basic truth. *M* stands for *mass*. So when, a few pages farther on in the physics book, you come across the formula $M = F/f$, you say to yourself with a knowing smile, "Mass is equal to *F* over *f*." You are wrong. *M* in this particular case means magnification of a lens. You are a little surprised at this, a little bewildered. *M* does not always mean *mass*. Someone has lied to you. As you leaf through your textbook you discover what I could have told you three months ago—that *m* is an inconsistent nymph of a letter.

Used by permission of editor of Green Caldron, freshman literary magazine published by the Department of English.

Having watched the chameleon-like antics of *m* in a physics book, you should be slightly prepared to learn that in chemistry and mathematics *m* represents new and entirely unrelated ideas. In mathematics the slope of a line is the tangent of the angle which the line makes with the *x* axis, if there is an *x* axis. The slope is denoted by none other than the roving kid himself, *m*. *M* as employed by the chemist, on the other hand, acquires new dignity, capitalization, and meaning. *M* is for *Molar*. *Molar* pertains to solutions. A one molar (1*M*) solution contains one gram molecular weight of the chosen substance per liter of solution.

M is combined with other letters, too, in order to save time and to clarify. *MG* is not mass times gravity. *MG* is the metacentric height in determining whether a ship will float or turn over. In chemistry *mg* is magnesium; in mathematics *MG* is the segment of an arc. *GM* is gram. *Mn* is the strength of the north pole of a magnet (physics) and manganese (chemistry), and a distance on a sphere of radius *r* (mathematics). You can readily see how incredibly simple scientists have made science by using the letter *m*.

Just as the design of the Timken Tapered Roller Bearing has been developed and improved steadily over a long period of years, so also has the manufacture of the Timken Bearing been brought to its supremely high standard.

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TAPERED ROLLER BEARINGS

VALUABLE SEA WATER . . .

(*Continued from Page 11*)

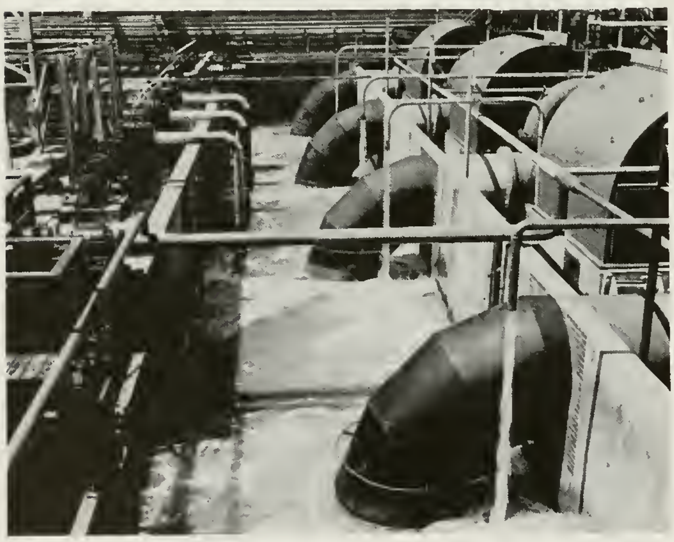
tions of process and controls were employed until it was demonstrated that 50 per cent of the bromine in sea water could be extracted and collected as the pure liquid at a satisfactorily low operating cost.

Thus for the first time an element was successfully extracted from the ocean—sixty-seven parts of pure bromine had been separated from a million parts of raw sea water. A desire for further exploitation of sea water led to the reclamation of magnesium.

In demand during World War I because of its use in flares and other pyrotechnics, improvements were made on its process of extraction, which consisted basically of the electrolytic reduction of magnesium chloride from brines. Magnesium in its pure form is soft and has little strength, while its alloys are strong and tough. Coupling these facts with its extreme light weight, its producers were convinced of its value as a structural material. It was the war ,however, with its new uses for existing materials, which brought magnesium its recognition.

Turning again to sea water, the producers of magnesium combined this with an abundance of cheap power, limestone, and salt; and in 1941 the first ingot of magnesium was poured—the first important metal in history to be taken from the sea.

The sea water magnesium process consisted mainly of treating the water with lime to precipiate magnesium hydroxide, followed by a subsequent treatment of hydrate with hydrochloric acid which reconverted it to magnesium chloride in much more concentrated solution. This was then evaporated and the dry magnesium chloride became the "feed" for the electrolytic cells.



Four Centrifugal Pumps Draw Sea Water into Plant

In operation it works like this. The sea water is drawn from a ship canal through large grid and rotary screens well below the surface and through a flume to the plant. Oyster shells are received at the plant by barge and are unloaded over a conveyer belt to promary storage. The shells are then put through a rotary screen washer and conveyed to a 300 foot rotary kiln where they are burned to lime. Since the shells are particularly pure calcium carbonate, the product of the kiln is a high-purity calcium oxide. The lime is sent directly from the kiln to rotary slakers and emerges as a thick slurry of milk of lime.

The lime slurry from the slakers is piped into a Dorr thickener 150 feet in diameter in which it is dewatered to a thick sludge. This thickened sludge drawn from the bottom of the thickener is sent into six launders on the surface of a flocculating tank where it meets the incoming sea water. Careful control of this operation requires precise adjustment of the pH of the mixture. A glass electrode with a calomel cell relays its readings to a recorder in the control house, where frequent laboratory titrations are made.

The resulting magnesium hydroxide floc suspended in sea water is then distributed to four 200-foot Dorr thickeners from which the hydrate is pumped to the filters. They are lifted, lowered, and shifted by means ofa 100-ton overhead crane. Suction is applied through the leaves until a cake an inch or more in thickness is built up on the leaves. The unit is then moved to an adjoining compartment where the cake is loosened by air pressure. This material is then mixed with magnesium chloride brine and pumped to the neutralizing unit where it is treated with crude hydrochloric acid and reconverted into magnesium chloride.

Flume Carries Water to Blowing Out Tower

The dilute solution is concentrated in direct-fired cylindrical furnaces, and the resulting concentrate further filtered and evaporated until it emerges as practically anhydrous magnesium chloride to be fed into the electrolytic cells.

The majority of the elements and compounds found in any appreciable content in sea water are now being recovered, and further utilization of this source must depend upon further advances in chemistry and engineering.

A. S. M. E.

At the first meeting of the winter semester, which was held on November 15, thirty-six persons were present, six of whom were from the mechanical engineering faculty. Professor O. A. Leutwiler, head of the M.E. Department, gave a short talk on the advantages of belonging to the student branch. Following this, election of officers for the winter semester were held:

Fred Lindstrom..*President*
Joseph Lyden......................................*Vice President*
Michael Martus..*Secretary*
Charles Rankine...*Treasurer*
Ernest Frazier...........................*Assistant Treasurer*

Serving on the program committee are Jaeger and Allen. Kenneth J. Trigger, Assistant Professor of Mechanical Engineering, is honorary chairman, succeeding Professor P. E. Mohn who is now at the University of Buffalo.

Many interesting and educational meetings are being planned for the near future. After the meeting was adjourned, cokes and doughnuts were served.

Campus News

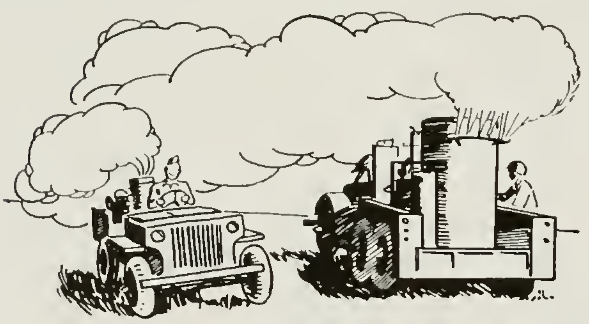
RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

CHRISTMAS DINNER IN THE TROPICS

IT is more than likely that many of the American boys in the South Pacific will have turkey for dinner this Christmas. It's not a military necessity, but it's good for morale, and high morale is an asset for any fighting force.

Good refrigeration equipment— the same sort that cools blood plasma, medical supplies, drinking water, and stores of ammunition— will make this possible.

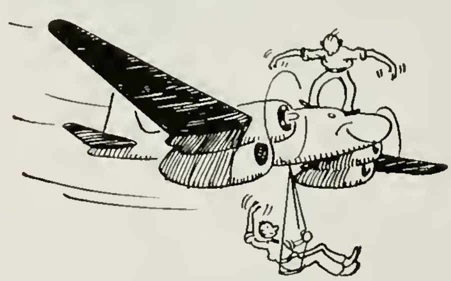
Recently, in collaboration with U.S. maritime and naval architects, General Electric engineers designed new, prefabricated refrigeration equipment for Victory ships which saves cargo space and materially reduces shipyard installation time. These refrigeration systems furnish 3½ tons of refrigeration for low temperature meat and fish rooms, and 3 tons of refrigeration at 40° F for vegetable, dairy, and thaw rooms. And six and a half tons is a lot of Christmas dinner in anybody's language.



JUNIOR

A LARGE smoke generator, principles for which were worked out by Dr. Irving Langmuir and Vincent Schaefer of the G-E Research Laboratory, produces a heavy blanket of smoke which has been used frequently to protect our men during landing operations. Now the Chemical Warfare Service has designed a smaller model.

"Junior" will fit into a jeep or a foxhole; can be carried by two men. With favorable wind conditions, it can blot out an area five miles long and 200 yards wide. The smoke will help the doughboys when the going is tough on jungle trails, mountain passes, and other vulnerable places.



NO STREAMLINING HERE

MOST airplanes look smooth. But some are definitely "lumpy." The plane which General Electric calls its flying workshop is of the lumpy variety.

It cruises high over Brownsville, Texas, carrying engineers and new equipment. Many new aircraft products and systems built in the laboratories and experimental shops of General Electric receive their first trial by air in this strangely shaped plane. It's one way G.E. makes certain that its aircraft equipment can stand the rigors of high altitude flying. *General Electric Company, Schenectady, New York.*

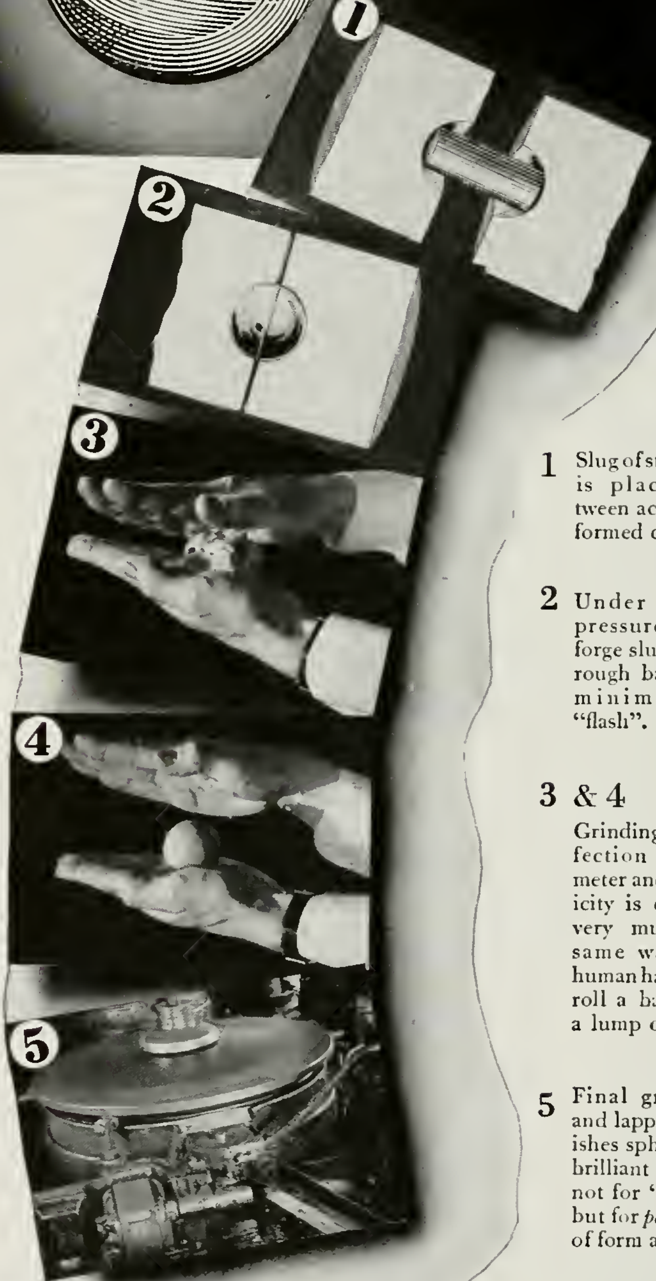
Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

The best investment in the world is in this country's future. Keep all the Bonds you Buy.

GENERAL ELECTRIC

953-96-211


Illinois
Technograph
January



While the steel ball is but one little part of a ball bearing, it's a most important part—and making it "round" is a most important and interesting process.

The extreme precision limits obtained (such as diameter within *two one-hundred-thousandths of an inch*) and interesting facts regarding the wonderful strength of the steel ball, are among the subjects covered in our little Booklet "BM".

We will be delighted to send you one for the asking.

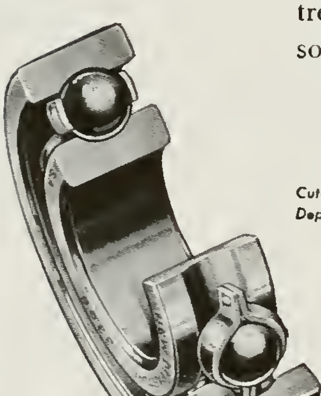
Meanwhile, remember that every mechanical device that helps make our civilization possible, has ball bearings in its family tree—somewhere—somehow!

1 Slug of steel wire is placed between accurately formed dies.

2 Under heavy pressure, dies forge slug into a rough ball with minimum of "flash".

3 & 4 Grinding to perfection of diameter and sphericity is done in very much the same way that human hands can roll a ball from a lump of putty.

5 Final grinding and lapping polishes sphere to a brilliant finish—not for "looks", but for *perfection* of form and size.



Cut-away view of New Departure Ball Bearing

nothing rolls like a ball

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The Tech Presents

☆ ☆ ☆ ☆ ☆ ☆

COVER—The cover shows the Grand Coulee Dam on the Columbia River in the state of Washington. This dam, built by the U. S. Reclamation Bureau has a volume of ten and one-half million cubic yards and will make possible the irrigation of 1,200,000 acres.

FRONTISPIECE—This view of the San Francisco-Oakland Bay Bridge, taken from Yerba Buena Island, shows the two mile West Bay Crossing with San Francisco in the background. This is only one-half of the gigantic structure.

☆ ☆ ☆ ☆ ☆ ☆


M 718

Everlasting . . .

CIVIL ENGINEERING

By BERT J. LEVEY, C.E. '46, V-12

This article is intended mainly to give the high school student an inkling of information of what the Department of Civil Engineering is like at the University of Illinois, what type of professors he might expect to have, and what civil engineering is like itself.

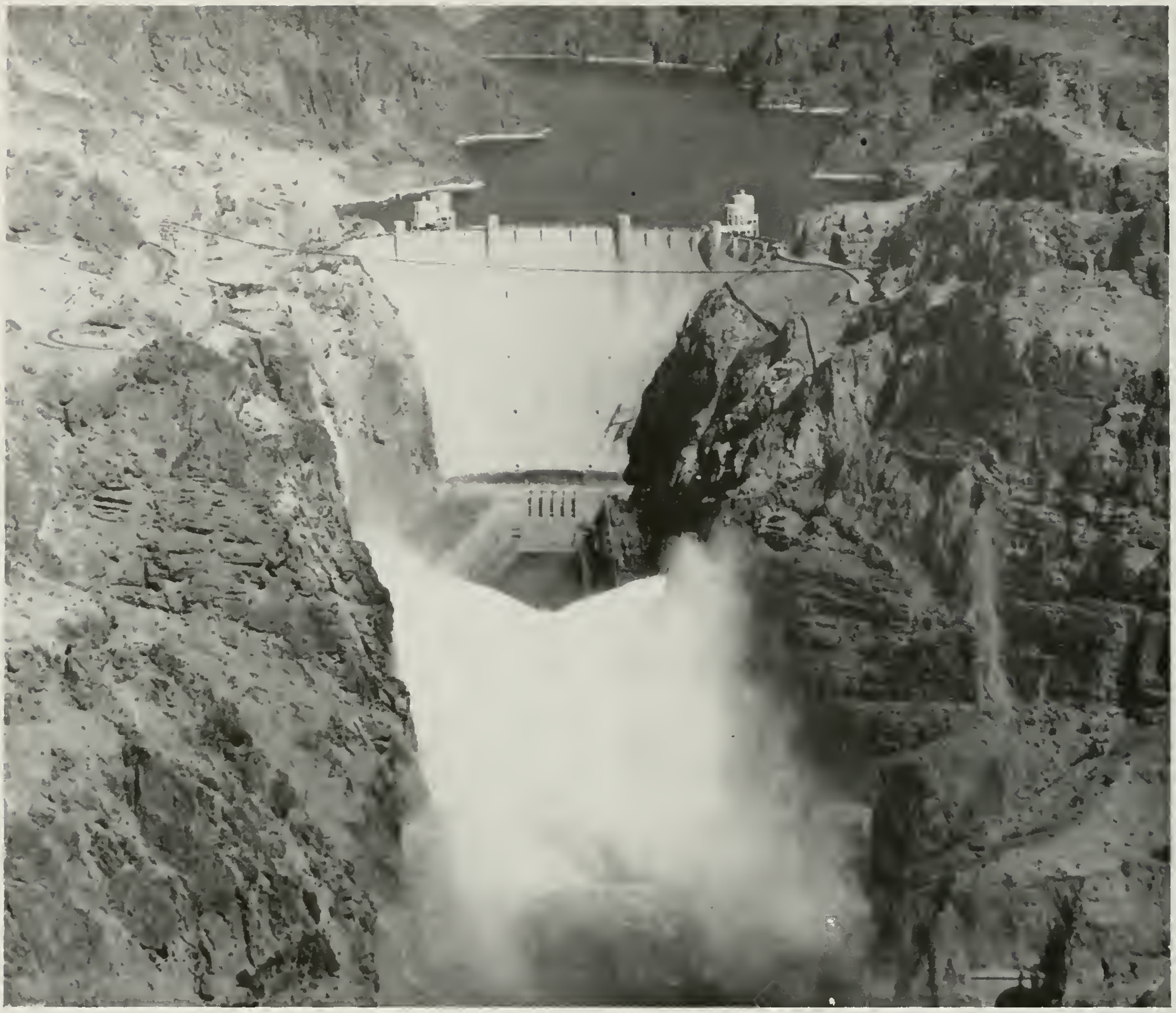
The ideas conveyed in this matter are not presented as a sales talk or any inducement for an unsuspecting high school student to come to the University of Illinois and enroll in the Department of Civil Engineering, but rather they are intended to give a clear cut picture of what he might expect to enter into if he desired to be a civil engineer. No matter how much information a student can acquire by going to his high school advisor or occupational director to ask what civil engineering is like, there is nothing like talking to a person who has already had the subject, to fully appreciate is worth.

You are now talking to a junior in the Department of Civil Engineering. And, although he has not gone completely through the course and received his degree, he has had the chance to acquire certain definite opinions, prejudices, and dislikes (if any up until now) for the work he is doing. Feel free to ask anything you like!

Noted throughout the country for its thoroughness in educating its engineers, Illinois' Department of Civil Engineering is one of the three in the United States that is rated as distinguished by the American Council of Education. Its methods of teaching and training its students for the work they will do are well chosen and have been refined with the progress of the engineering. Its standards are modern and keep its engineers in constant touch with the latest practices that are developing in the field. You will find that the background and foundation that you acquire from this department will equip you for any specialty you desire to follow. The department has arranged its courses in such a unique manner that you do not have to wait until you are almost a graduate before you get taste of the engineering you are in. At the very beginning of your sophomore year you can start to delve into the civil engineering resources. Perhaps you may thing that this is a strange point to make, but it is not; for in other colleges, you rarely are allowed to enter a course pertaining to the subject until you are a junior. The courses are so arranged that you will be allowed to test all the different branches of civil engineering before you make a choice as to your specialty. And scattered throughout your curriculum are courses that will give you a smattering of knowledge of what the other fields of engineering are like. It has been this excellency in arranging for its students and wisely choosing the path its engineers take that makes this college recognized throughout the country for its distinguished program.

The department is also the second largest of all civil engineering department in the country. On the campus at the University of Illinois, one of its most beautiful and recent buildings is the Talbot Laboratory, which is one of the foremost of its type in the country. It has hundreds of different testing machines, among which is one that is capable of applying forces from the unbelievable amount of three millions of pounds down to a few ounces. The laboratory is continually making tests and studies of many different problems. Some of these problems are for new design of airplane propellers for our warplanes, lighter, stronger railroad car wheels, tests on railway rails, concrete design experiments of every type practical and imaginable. In the basement of the building, the men of the department have designed and built machinery to duplicate the tremendous forces that occur when a train goes around a curve, and also the starting and stopping effect of train wheels on tracks. The student receives much of his practical experience by doing work with similar machines in some of the class rooms of Talbot laboratory. In this building are also facilities for the student to study hydraulics. Another of the civil engineering buildings is Engineering Hall. Housed in this building can be found design rooms, libraries, and class rooms for more theoretical studies which don't require laboratory work with testing machines. A sewage disposal plant also offers the possibilities for extensive study in this branch of civil engineering. At another end of the campus can be found the "C. E. S. B.," which you no doubt will guess is the Civil Engineering Surveying building. Here is where you first become acquainted with the curriculum you are taking by your experience with surveying. It is little wonder with the facilities for carrying out its active program of research and teaching that this department is the second largest in the country.

Perhaps you have heard stories about professors. Those black-hearted, rakish devils that carry their textbooks around by spearing them with the end of their tails. Those monsters of study and learning that stomp back and forth on the lecture platform, and if a student falls asleep, he is awakened with the crack of a big, black whip. Those Neros that sit and twiddle while you flunk the hardest test ever created. Have you heard those stories about professors? Well—they are not *all* true! Especially about the pedagogues in the civil engineering courses. You'll be surprised how many of them are very real people that have the interest of their student always in mind. The civil engineering professors are all well qualified for the jobs they do in the classrooms; in fact some of them are the leading men of the country in their specialty. (Now, perhaps this junior that you are talking with will flunk out after his professors read this, but there is nothing more intended than the passing on of a light character study made unavoidably during class hours.) These are the men that will teach you the finest civil engineering in the country; they are not devils



BOULDER DAM
The pictures on these pages are examples of the work of civil engineers

or demons, but outstanding men that are as real and natural as your father.

Professor Vawter will teach you anything you'd like to know about structures and their design. He's an alderman of the city of Urbana and the co-author of one of the country's leading textbooks on "Theory of Simple Structures." He would make an ideal Santa Claus except that he has no beard. But when he laughs, there's a merry twinkle in his eye and his belly shakes almost like a bowl of crushed cranberries. His mind is like a perfect bridge, it never fails, and always carries the load placed on it. When he lectures he paces over and across the room with heavy steps. This, probably, is to keep his class awake, for it has to study late and long to perfect the assignment that was made. But if someone does happen to be overcome with drowsiness, the professor will gently tap him on the shoulder and continue to lecture.

Rex Brown is one of the men you might meet in a testing and materials course. (These courses are usually held in Talbot Laboratory.) Rex, as his pupils more affectionately address him, comes into class each cold winter morning and just like clock work, he passes out the papers from the day before, walks over and stands by the radiator so that the rest of the class can not get any heat and won't be comfortable enough to sleep, and then says, "What was the problem for today?" That almost always catches everyone. Rex is usually pretty sober minded, but one day, while he was talking about the internal forces acting on a door, he quizzed his class in his best monotone manner, "Now, what will happen if you came running in the house one night and bumped into the door?" Everyone burst forth with every force equation he knew but all the answers were in vain. Rex waited until the rabble subsided and then he gave the answer, "You'd get an awful jar, wouldn't you?" Whereupon everyone burst into laughter, and Rex wrinkled both lines in his face.

Professor Wylie has been with the civil engineering staff longer than any other man. He tells you all there is to know about laying out railroads and highways. He's the kind of a fellow that laughs at himself more than the pupils do. When you first come into his class each man tells his home state. As soon as he finds two men that are from states that are bitter rivals, he stands them up together and lets them "slug" it out. All the while he sits on the top of his desk laughing. He tells you the oldest jokes you've ever heard; but the way he roars at them, you can't help but laugh, too. For instance, his favorite is "Social Security—You don't get it? Well you won't 'til your 65!" See what I mean?

Of course this undergraduate sincerely hopes that neither you nor his professor will take these personalities sketches too seriously. Except in the one way that all teachers that you will meet while studying civil engineering are "right guys."

What is most important, however, is what civil engineering is really like. It is the most fascinating thing you ever thought about. All you have to do is look at the work done by civil engineers to see that. The bridge spanning the Golden Gate, a tunnel, a subway, a highway, a skyscraper, and innumerable other things will show you that the study could be nothing less than fascinating. It is something that lives and breaths; it is real, it is not just THERE. It has a life about it that is a part of humanity; for all life depends upon civil engineering. It's an art that is fine and accurate in every measurement, yet paramount in its scope of construction. It is strong, and big, and fills the world with all its wonders to see. It is on the inside; it's outside; it's wherever you are. It is a science that the world could not get along without. It is unmistakably fascinating.

Intensely interesting, civil engineering is understandable and filled with common sense. Many people might say that this engineering is easy. Well it is not easy in the sense that you don't have to work to get it! For it is a lot of work! But what they might mistakenly call easy should be termed understandable. For in so many of the engineerings, you might study for semester after semester and never really know why you do what you are told to do. Whereas in civil engineering you can follow most any process through with logic.

Now, you perhaps have a little more information about civil engineering as it is at the University of Illinois. The department is one of the finest in the country, the men that teach it, all members of the American Society of Civil Engineers, are all specialists in their field, and the subject itself is unsurpassable. Perhaps you too would like this Civil Engineering.

CLOVER-LEAF HIGHWAY INTERSECTION

AERIAL VIEW OF U. OF I. AIRPORT

AIRPORT . . .

University of Illinois

By BERNARD W. JACOBSON, C. E. '45

The construction of the University of Illinois airport started May 31, 1944, under the direction of the Civil Aeronautics Administration as construction agency. Two separate contracts were let, Johnson Greene Company, Ann Arbor, Michigan, contraction for the drainage and grading, and Cooks Contracting Company, Detroit, Michigan, contracting the paving.

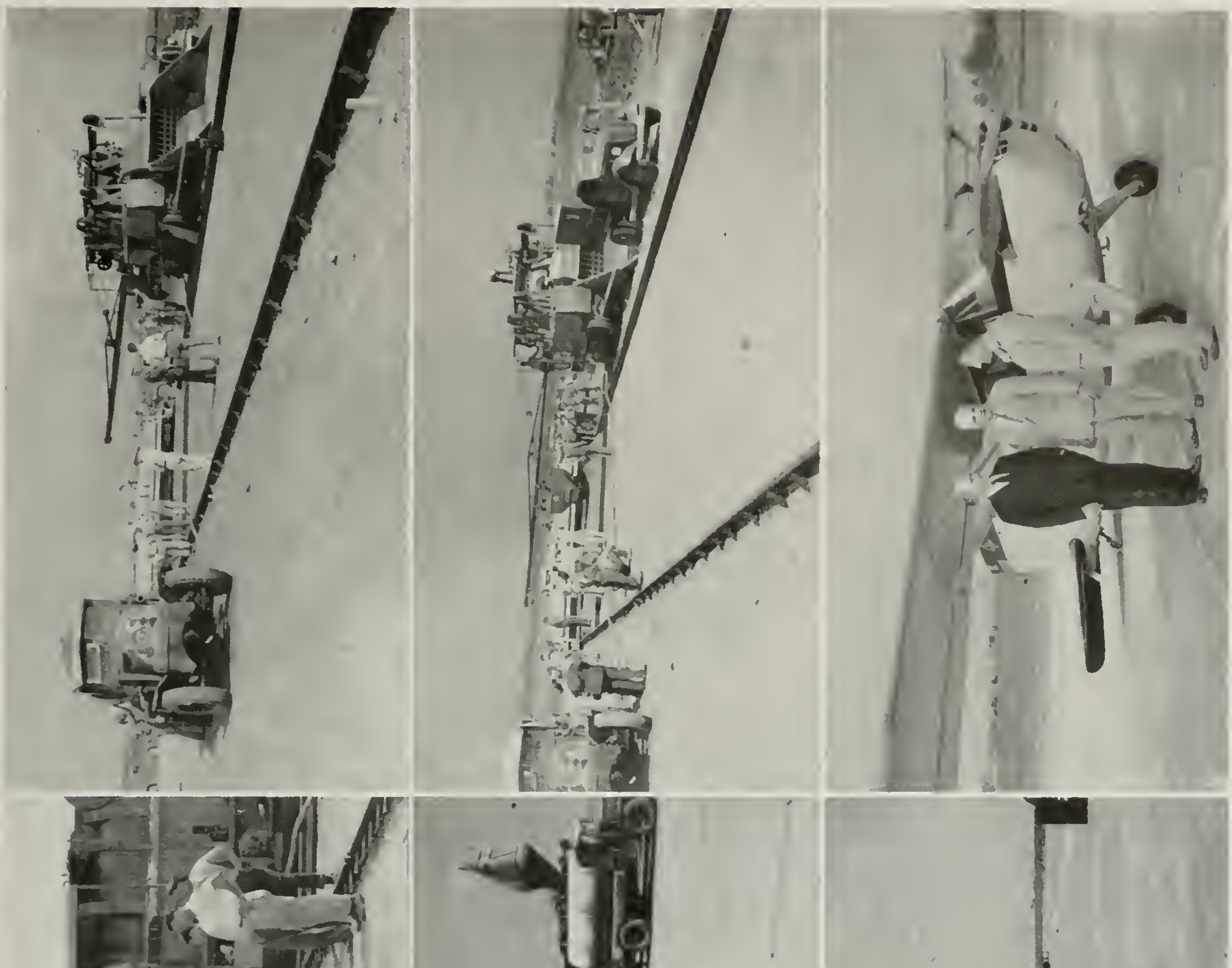
Clearing began almost immediately, and trees and brush were removed by common labor and bull dozers. Fences were removed and all serviceable fencing salvaged for future use. In as much as the area was essentially farming land, little work was required in the way of building removal.

Once the land was cleared, contracting operations started in full swing, with grading and drainage being the main items. Drainage, a very important item, was pushed to the fullest extent, in as much and little surface work can be done until practically all the subsurface work is completed. The drainage consists of small, open, painted pipe stretched almost the full length of the runway, parallel to it, and on both sides of it. This is the only way to collect the rainfall on the runways, and prevent the water from flowing over the shoulders where it would soften the subgrade. These border drains are buried approximately four feet deep, the points covered with a porous filter to prevent excessive soil removal and yet remove the bulk of the runway moisture that would otherwise soften the subsoil. These side drains flow into catch basins of the regular drainage system at frequent intervals, and the water is thereby carried away from the airport.

From the edge of the runways, the ground is shaped to a slope not greater than one percent. This provides a sufficient slope to render any part of the airport usable after a rain. This eliminates the problem of water puddles standing in open areas. These slopes all drain to catch basins that lead to the regular drainage system.

This drainage system comprises about seventeen miles of drainage conduit, diameters varying from 12 inches to 72

(Continued on Page 14)



CONSTRUCTION SCENES

U. OF I. AIRPORT . . .

(Continued from Page 12)

inches. The discharge is about evenly distributed to two outfalls, one to the east of the field, the other to the west; and a small area in the southeast corner drains into a creek.

Because of the triangular shape of the airport and the odd shapes of areas cut up by the taxiways, many catch basins are needed to collect the drainage from the side slopes.

The western outfall paralleled a public road, thus necessitating covered pipe for its entire length until it reached the outfall stream. The eastern outfall, after it leaves the airport property, travels through a farm and is an open ditch over the farm area until it flows into the outfall stream west of the highway. The open ditch was cleaned out, enlarged, and the slopes cut to an even grade by machine and hand labor.

In the stripping operation, the sod to a depth of 4 to 6 inches was first removed by La Forneau's and bulldozers and stockpiled for use later. Then the work of grading commenced! The runways were excavated to a depth of 18 inches below finished grade. Soft spots were excavated and refilled with suitable material and then the whole area was rolled and compressed by sheepsfoot rollers; in some instances, to obtain maximum compaction, as many as 15 passes were required of the roller. Areas subjected to fill were first stripped of sod, the fill carried in and deposited in 6 inch layers, then the whole area rolled and sheepsfooted until desired compaction was obtained.

At the same time that the grading was under way, the sewers were constructed. Often, an area would be completely graded and compacted, when the drainage crew would cut an open ditch, sometimes as much as 15 feet deep and 20 feet wide right thru the center of a completely graded area. This is often necessary when there is not sufficient time for the completion of the drainage construction before grading starts. Also, it happened occasionally that a drain was constructed thru an area at a rather deep cut, and later the grading crew came by and removed 4 or 5 feet of earth from the whole area. A few such instances occurred at the U. of I. Airport, but it can be said that as a whole the schedule of operations was such that few such instances occurred.

The side drains were built by a Cornching machine. In as much as the pipe was only about 4 to 6 feet deep and of small diameters, the drainage system of large pipe was built in cuts made by clam and dry line. In places this open cut was as much as 25 feet below ground surface and pipe of large diameter was installed.

Because the soil was of very sandy texture in spots and often very moist, side slopes were sometimes cut back to almost 1% to prevent sloughing and sliding. The pipe, especially in the larger sizes, was lowered into the trench by large cranes; for they were too heavy for men to handle. Even in the smaller sizes a light portable crane handles the pipe more efficiently than if the conduit were lowered by manpower.

Except for the side drains along the runways, all joints were made solid and full, plastered on the outside with a cement mortar, and the inside smoothed and plastered evenly. With such a flat terrain, grades were rather flat and more than usual care required for the accurate alignmont of the drains. Batten boards were set and checked by survey parties and a very close inspection was made by the construction inspectors. With the three outfalls, three different sewer crews were possible and simultaneous operations were possible. Drainage lines were laid continuously thru catch basins and junctions, and the structures were built by crews following up the line crews. After the pipe was laid, the drainage structure footing was excavated, the foundation of concrete was poured; and, after setting, the upper half of the pipe was broken out. Then the remainder of the drainage structure was built up to finished grade.

Simultaneously with the drainage, excavation sub base construction was started in areas where grading and drainage would no longer interfere. Subbase construction called for optimum compaction as described above, then rolling with 12-ton rollers to a finished subgrade. Variation from plan was less than one quarter inch.

Concrete pouring started only after sufficient subbase had been laid to warrant continuous concrete construction without shut down for waiting. Concrete was laid in lanes 35 feet wide and construction joints put in approximately every 100 feet. Alternate lanes were laid with steel side forms on both sides. The introvening lanes were built using the existing concrete as side forms.

Concrete was batched by hoppers built at the airport site, and trucked to the mixers operating alongside the runway strip being paved. Cement was shipped by rail from Buffington, Indiana, the sand from Lincoln, Illlinois, and the rock from Kankakee, Ill.

Each mixer was a 34 cubic foot dual drum mixer. Water was furnished by tank truck and was also pumped thru pipe lines laid from Savoy to the airport.

The mixed concrete was dumped between the forms by the mixer. A spreader distributed the concrete evenly to all points between the forms. Two finishers followed, the first transverse, the second longitudinal. The jointers platform came next, followed by a hand finisher, and finally the platform carrying and distributing the spray curing compound. Water content was watched very carefully. samples of finished concrete were taken frequently and tested and the resulting concrete should sustain planes of 1,000,000 pounds or more. This is three times the weight of modern 21 passenger planes used by airlines today.

The runway plan called for a 1% crown slope and the subgrade likewise. This 1% slope gives enough grade to drain the subgrade and prevent percolation of water below the concrete into the subgrade to caus efailure. The sub base was constructed of two layers of sand gravel mixture, each 4 inch thick, rolled, and compacted to optimim density, forming an almost solid roadway on which to build the concrete slab. Enough silt, and earth was in the run of bank mixture to give a solid base course suitable for the average secondary road. Traffic over completed sections served only to bind the material even more firmly and rain had no ill effect for the 1% slope drained all water off well enough to permit work to proceed within 24 hours after most rains. Inasmuch as the runway is 150 feet wide, the subbase was built in two strips. One side was traffic bound while construction proceeded on the other half. When it is realized that over 100,000 cubic yards of bark sand and gravel was trucked to the airport from Mahomet, Illinois, a distance of 15 miles, the site of a modern airport becomes clear. Before concrete was started, lighting duct was laid in concrete from below the runway for future night lighting. This is a fiber duct tube 3 inches in diameter, laid on a minimum grade of 1% to provide drainage and encased in concrete for protection against failure of the slab above. Later when night lighting is added to the airport, runways will not necessarily be torn up to lay the light cable across them, because the cable may be pushed through the duct.

Following completion of runway and taxi-way paving, shoulders were shaped to the edge of pavement and compacted. Side slopes were smoothed, rolled, and compacted. The runways, taxiways, shoulder blading, and grading were all 100% completed before winter set in; and the airport will be suitable for landing in the spring.

Buildings and service accessories will be constructed later, along with night lighting and landscaping.

WHEN SHOULD ENGINEERS BE LICENSED?

By OTTO TURNOVSKY, Met. '45

Among the many controversial subjects that find their way into the engineering field are the following two: is there need for an all-engineering super-society; and, when shall an engineer be accepted for licensing into the profession?

It seems that some difficulty lies in the settlement of both these questions because of what appears to be a clarification of a definition. In the former, the question, what constitutes an engineer, and in the latter, what is the definition of professional engineering, are among the many bottlenecks.

Concerning the question of an all-engineering super society, certainly with the civil, mechanical, electrical, metallurgical, and all other types of engineers, there are the definite basic sciences, physics, chemistry, mathematics, etc., common to all of these which are used in each profession. Aside from these are the special sciences which are a part only of each particular type of engineering. Since the basic sciences are a part of all types of engineering, it seems obvious that these are then the most important. In fact, it has happened time and time again that engineers graduating from one phase of engineering specialize in another phase after entering the industry.

Concerning this condition among engineers, Mr. F. J. Sette, Deputy Administrator, Rural Electrification Administration, Washington, D. C., said in an address before the annual meeting of the Virginia Student Chapters of the A. S. S. E. at Virginia Polytechnic Institute, "With all this overlapping, you can see that the unification of all engineers into a common engineering association or group would be a natural development. There is, of course, room for associations or societies dealing in specialties. But the need today is for a master organization, guaranteeing professional recognition and economic protection."

Even more now than at any other time is it important for a unification of engineers, for the future holds many problems that each eengineer alone will find difficult to solve, but that all working together will produce better results, quicker and of more lasting quality. As Mr. Sette puts it, "With the trying times that lie ahead in our modern world, I believe there should be a real unification of the engineering profession—so that the whole group may work as an organized entity in building, over the ashes of today's conflict, a world economy that is sound and sturdy."

One thing that must be recognized about the profession is that its effects on society are as a whole and not according to its individual phases. Through its operations, the profession imposes upon society problems that society alone has had to solve. With a unified profession of engineers, these problems would perhaps not be greatly reduced but would certainly be in such a positon as to be dealt with in one blow rather than with a succession of blows.

In regard to the question of a new licensing law, one is prone to ask, "Where can a sharp line, if any, be drawn between the professional engineer and the mechanic or technician?" Perhaps the realization that engineering needs basic academic studies for professional preparation and that experience by itself cannot replace time spent at a university is a point of reference through which this line can be drawn. Perhaps also, a new and more accurate definition of professional engineer would be another reference point.

Here also, as mentioned above, are the basic sciences of major importance. Any attempt to train individuals for engineering by practical courses involving specialized subjects to the exclusion of the basic subjects is doomed to failure.

Engineers generally are not willing to license graduates directly after commencement as do the professions of medicine and law. A period of "Engineering Training" seems to be desired in the opinion of most older engineers. The first few years of practical work, after graduation, actually do little to deepen the general professional knowledge. Their main influence, however, on the young engineer is in introducing him into the human side of engineering. As this is not part of the license (although important for success) there seems to be no reason why licensing should not follow immediately after graduation.

If then licensing is

a) limited to graduate engineers.
b) based mainly on many general sciences and a certain number of special sciences.
c) permitted following graduation

it will be relatively easy to define who will have to be licensed and what professional work requires a license.

Although the above point in a definite manner to answering the questions stated here, they are simply the opinions of a few men and are mainly introduced as suggestions for discussion.

"May I take you home? I like to take experienced girls home."

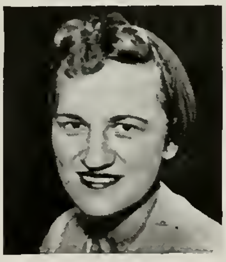
"I'm not experienced."

"You're not home yet."


They came out of
TO DO A "NEXT-T
A DELICATE JOB! Some parts of superchargers travel faster than the speed of sound. Every part must be perfectly balanced and fitted.
SUPERCHARGER
SUPERCHARGER
SUPERCHARGER
SUPERCHAR
EVERY FORTRESS NEEDS FOUR . . . to feed air to oxygen-hungry motors at high altitudes.
"ENGINEERING THAT AIDS ALL INDUSTRY FURTHERS AMERICAN GOOD LIVING"
OVER 1600 PRODUCTS
—Supplying the Worl
ALLIS

ne Kitchen—

POSSIBLE" WAR JOB!

low Allis-Chalmers Engineering put women work Mass-Producing what had been virtually a Master Machinist's Product—

FLYING FORTRESS SUPERCHARGERS!

No PLANT! Not enough men! All Allis-Chalmers had when it undertook the "impossible" job of mass-producing precision-built Fortress superchargers was a plot of land and engineering *imagination* and *experience* gained from supplying the world's largest line of major industrial equipment.

Yet, within 8 months, this "know-how" built a new, efficient plant—simplified many difficult jobs—helped thousands of women become machine operators, inspectors, testers! Today, this plant (with 60% women employees) is turning out superchargers in great quantity!

What will YOU want to build?

We're adding daily to the broadest industrial engineering experience in the world . . . are adding such things as the revolutionary gas turbine to our list of 1600 products. No matter what your manufacturing problem—it will pay you to consult Allis-Chalmers!

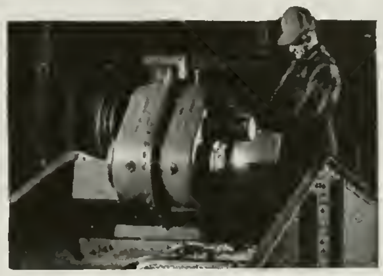
ALLIS-CHALMERS MANUFACTURING CO., MILWAUKEE, WIS.

VICTORY NEWS

How to Train Women Workers! In conjunction with the U. S. Air Forces, Allis-Chalmers has produced an educational movie, "Woman Power," showing how women with no previous training or experience, were taught to perform all of the intricate jobs at Allis-Chalmers' new supercharger plant.

The movie shows how to train women war workers, how to provide for their comfort, health and happiness in a factory job. It will be loaned to management and supervisory groups faced with the necessity of adapting woman power to manpower shortages. Write or wire Allis-Chalmers, Milwaukee, Wis.

More Help For "Sink-Float" Plants: To facilitate wet screening and dewatering, Allis-Chalmers has designed a new End-Tension Deck for Low-Head Vibrating Screens.



New deck construction assures uniform depth of product and maximum use of screen surface for more efficient operation. Write for Bulletin B-6321.

Electronic Giant By A-C: Big factor in breaking the aluminum bottleneck after Pearl Harbor was the Mercury Arc Rectifier—the world's biggest electronic device—introduced to America in practical form by Allis-Chalmers.

In one simple operation, the A-C Mercury Arc Rectifier converts alternating to direct current, the electric power needed for mass processing of aluminum, other vital war metals. Helps keep U. S. plane production on schedule!

FOR VICTORY
Buy United States War Bonds

rgest Line of Major Industrial Equipment

CHALMERS

PERSONALITIES . . . *on the campus*

PROF. W. C. HUNTINGTON

Heading one of the outstanding Civil Engineering Colleges in the country, Professor Whitney Clark Huntington has guided this department for the University of Illinois since 1926.

None the worse for the dominate role that he has played in civil engineering, even with putting up with scribes who query him about his life's history, Professor Huntington has retained a cheery and friendly personality.

In a modest, unassuming office, rather crowded with papers, books, files, and extra articles of furniture, Professor Huntington is always ready to greet his students. He liesurely sits behind his large desk and is very relaxed while talking. His clothes have as much an impersonal attitude as he himself does and seem to ideally fit in with the room and this man who has done so much in the civil engineering world.

Professor Huntington started his education at the University of Colorado where he received the B.S., C.E., and M.S. degrees. The professor stayed at Colorado long enough to become head of the department and also head of the construction department. In his interesting work as chief of construction, he had charge of the preliminary design and building of the English Laboratory building, the Liberal Arts building, Chemistry building, the Medical school, and other prominent buildings on the campus of the University of Colorado.

In 1926 he relinquished his position at the western school to come to the University of Illinois as professor of civil engineering and head of the department. Since the professor has been here he has also done work of outstanding value. Among his accomplishments is his organizatioin of the staff of Civil Works Administration for the state of Illinois. This project included forming an organization to supervise engineering operations and the purchase of materials and equipment for 200,000 men. This involved the expenditure of sixty million dollars! And these deeds and honors are but a few of those that Professor Huntington has attained.

Colorado still holds a soft spot in Professor Huntington's feelings, however, for during the summer he retires to its scenic mountains for refreshment and outdoor activity. And when the professor isn't working at his professional interest of dams and buildings, he enjoys doing ornamental lettering. Of course his greatest interest in life is his charming wife and two daughters, one of whom is doing Red Cross work. The other is still in junior high school.

And so it is that this man of unlimited accomplishments heads the Department of Civil Engineering for the University of Illinois. It is little wonder that this department is one of the best in the country.

W. M. LANSFORD

Wallace Monroe Lansford, associate professor in Theoretical and Applied Mechanics at the University of Illinois, was born in Shobiner, Ill., February 28, 1900. He attended St. Elmo High School, Fayette county, Ill., and upon graduation taught at a rural school for one year. Fresh from a single-room country school with eight grades,

he proceeded to the University of Illinois to study civil engineering.

During his first summer at Illinois he worked with the city engineer of Urbana, and in his sophomore year, with Western Electric in Chicago.

(Continued on Page 22)

Army Specialized Training Program

By WILLIAM VICINUS, ASTR

In a balanced army, well-informed soldiers, college-trained and well-taught in army life, are extremely useful. They are found to be able to supply a body of men for preparation as intelligent and necessary non-commissioned officers. Members of such a group also seem to have a better preparation for and a start toward becoming an equally useful source of supply for commissioned officers. With this in view, the Army Service Forces set up the Army Specialized Training Program. The best colleges for supplying a highly technical education were selected to carry out this plan of training.

The program guarantees nothing to the seventeen-year-olds who join. These men first pass mental and physical requirements to make them eligible. They are then sent to a college or university within the service command in which they enlisted. They are given a two- or three-term course, depending on their age and their ability to maintain scholastic standing. When the trainee becomes eighteen years old, he is allowed to finish the term in which he is working. He is then given a two-week furlough, after which he is sent to basic training. Upon his arrival there he is well equipped to be a better soldier and has had training valuable in achieving promotion. Thus both the army and trainee are well recompensed for the time and money spent in the training.

Since the army has set up this special training program for the sole purpose of training men before they reach draft age, there is little time for play in the trainees's day. The intensive curriculum emphasizes technical subjects. joining the program does not insure anyone a non-commissioned grade, but the increased knowledge and advanced training in military methods and manners, gives each man the opportunity for advancement at a rate corresponding to his proficiency. The reserve program is also a screening period for the more advanced A. S. T. P. Because of the drastic curtailment of this program the army will not send men for further training unless they have already proved their worth. The purpose of the A. S. T. R. program could be summarized by saying that the army has sent the men here to prepare them to do a job, and it is preparing the trainees in the quickest and most complete way compatible with sufficient understanding.

The U. of I. Unit

In August there arrived in Champaign approximately four hundred raw recruits. In the first few days, they were classified, by tests designed to bring out past experience and ability, into two main groups, N and B. The N programs, N 10 and N 20, were designed for students with less previous training especially in science and mathemtaics. Their curricula merely started a term lower and worked up to the B or basic curricula. This basic course is essentially the ordinary freshman course on an accelerated and concentrated schedule. The twelve week term necessitates a condensation of material, but, for the most part, this condensation has accurred in the period usually allowed for the sinking in of knowledge. There is little superfluous material offered and the students must grasp the essentials and pick up the practice and proficiency in later handling. This has its advantage to the military in that the basic knowledge is covered thoroughly, and that is what the men are here to learn.

The military system was worked out in the first few days also. As the trainees were classified, they were assigned to sections under a cadet system in which men with previous military training in the R. O. T. C., or C. A. P., were given cadet officer grades. These officers are changed at the beginning of each term, new officers being appointed on the basis of military performance. These men act as immediate superiors and are responsible to the staff officers in charge of the units. They are responsible for maintaining order in their section and carrying out the orders from the officers in charge.

After the first few hectic days, the university campus began to see more of the army. They marched from class to class in sections. They lined up in front of Harker Hall waiting, with hungry looks on their faces, for chow; and this generally became a feature of college life. But in spite of their numbers and their numerous activities, the boys are still relatively unknown and misunderstood. The main reason for this fact is that their activity is mostly in the realm of studies and their minds and efforts are focused on the project of absorbing knowledge. For this reason, the army is completely separated from college life as the civilian knows it. The program has been mapped out and has been balanced so that every hour of the day has its appointed duty. The only argument against this regimentation is that it is failing to prepare the men to work actively in a community on diversified projects. To this the answer is that there is a war to be fought now, and their intentions are to help win it.

The program itself consists of twelve week terms, each man carrying twenty-five credit hours, with the emphasis on the technical subjects, mathematics, physics, and chemistry. The mathematics program starts with trigonometry and college algebra the first term. From these the courses proceed in regular college order, of course faster, to analytical geometry and fundamentals of differential and integral calculus, the third term. This program is planned to give a basic knowledge of the modern techniques in mathemtaics so that the men are better able to handle technical problems such as the firing of large caliber guns. The physics course starts with mechanics, first term, magnetism and electricity, second term, and heat, sound, and light, third term. The chemistry course is the regular freshman course. It is compressed into two terms and given in a condensed fashion.

During this time they also study subjects that make better soldiers and better citizens. These subjects include rhetoric, history, and geography. History is essentially a course in background material of World War II. Thus they become acquainted with causes and results of conflict and hopes for establishing permanent peace. Geography, which is divided into physical and economic, in order to give a clear idea of the area in which the fellows might be sent, the topography of land, climatic elements influencing it, and

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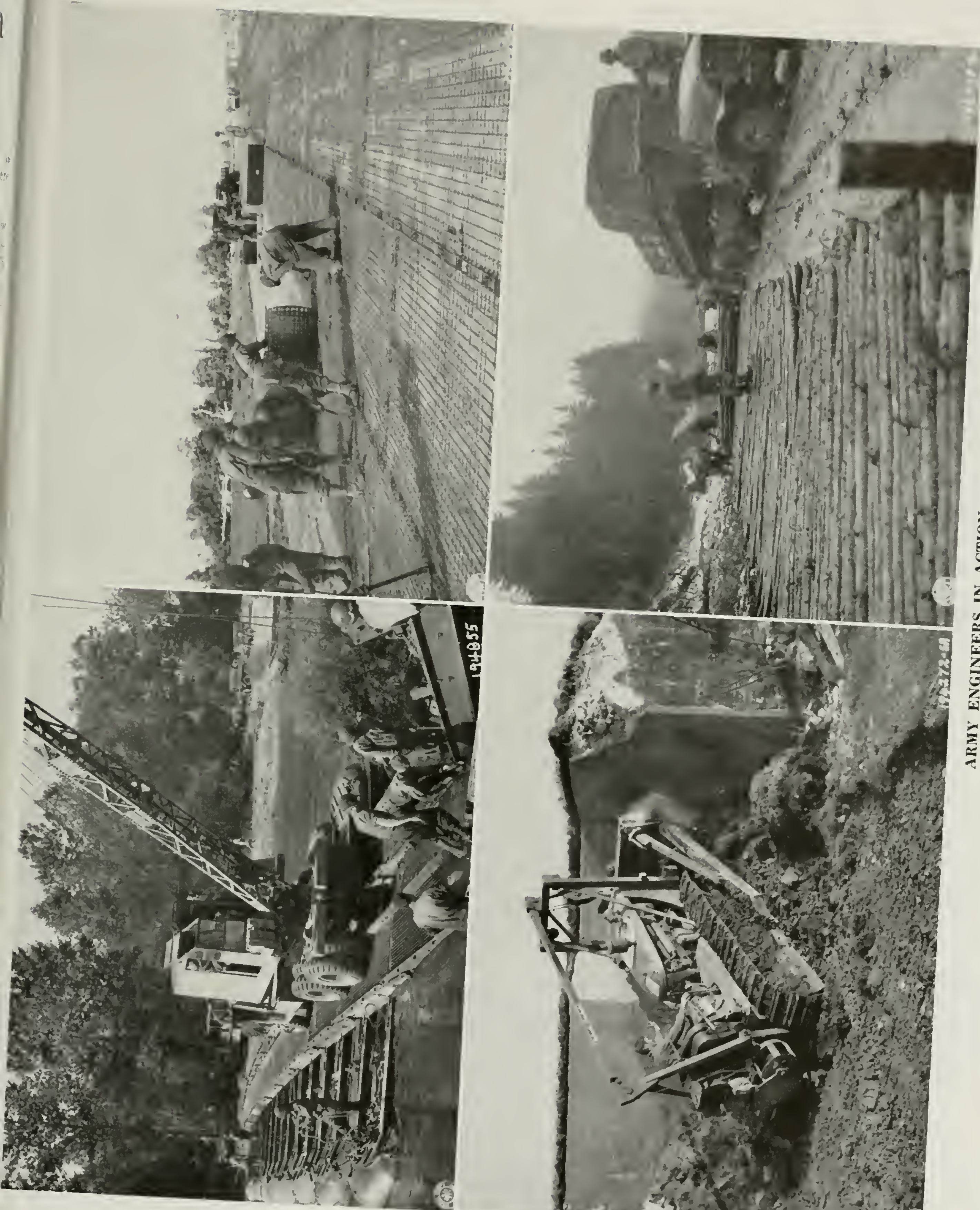

Signal Corps Photos

ARMY ENGINEERS IN ACTION

PERSONALITIES . . .

(Continued from Page 18)

Graduating with a B.S. degree in Civil Engineering "Wally," as he is known by his friends and associates, accepted a job with the city engineer of Champaign with whom he remained for three years. From Champaign he traveled to Chicago to accept a position with Kelker DeLeuw and Co., consultant engineers. In 1927 he returned to the University to earn his master's degree which he received in 1929. In 1932, he received the professional degree of Civil Engineer.

The year 1928 was the beginning of Wally's association with the University of Illinois. Dean Enger, then head of the Theoretical and Applied Mechanics Department, offered him the position of research assistant in the cast iron investigation. The object of the project was to improve existing specifications of cast iron water pipe. Subsequently University of Illinois engineering bulletins showed the success of Wally's efforts, notably, Civil Engineering Bulletin 100:1018, 1935, "The Use of an Elbow in a Pipe to Determine Rate of Flow," Lansford, W. M.

Wally has been teaching at the University of Illinois since 1929 though for the last 10 years his abilities have been devoted to the field of hydraulics. Typical of his excellent record in Mechanics of Fluids was his position as consultant engineer in the Illinois State Underground Water Supply Survey in 1941-42.

Wally's hobby is "work" which can readily be attested to by students in his classes. The publication of several bulletins and papers by engineering technical societies and the University of Illinois Engineering Experiment Station and membership in the S. P. E. E., A. S. C. E., Sigma Chi, and Chi Epsilon also show, though more substantially, his interest and ability in his work.

A smile tugs at the corners of Wally's mouth and a twinkle appears in his intense blue eyes when he talks of his two-year-old daughter and his seven-year-old son who "wants to run the big machine in Daddy's building" when he grows up.

JOHN GIACHETTO

John Giachetto is another of the V-12s who will finish his college career at the University of Illinois this semester. By trade he is a chemical engineer, and incidentally, is the only one of his kind graduating this semester. John has put in eight semesters of hard work and can boast of an average well above the 4.5 mark. As is the case with most good scholars, John also believes in having his share of good times.

John comes from the small mining community of Wilsonville, Ill. However, he went to high school in Gillespie, Ill., and was active in the school clubs and activities. He was valedictorian of the 1942 graduating class and also won the four-year county scholarship to the University of Illinois.

The same month of high school graduation, John entered the University of Illinois as a chemical engineer. He immediately showed his ability to work and to forge ahead by qualifying for Phi Eta Sigma, freshman honorary fraternity. At the end of his third term in college, he entered the V-12 program and was fortunately stationed here. John

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One of the briefest musical criticisms on record appeared in a Detroit paper:
"An amateur string quartet played Brahms here last evening. Brahms lost."

* * *

Discussing the type of milk which should be supplied to school children, the twn's health committee said:
"What this town needs is a supply of clean, fresh milk, and we should take the bull by the horns and demand it."

* * *

He: "I hear that there is a baby born every minute in New York."
She: "Well, don't look at me that way. I live in Buffalo."

* * *

Teacher: "Give the principal parts of the verb 'swim'."
Johnny: "Swim, swam, swum."
Teacher: "Good! Now give the principal parts of the verb 'dim'."
Johnny: "Aw, quit yer kiddin'."

* * *

Professor: "What kept you out of class yesterday—acute indigestion?"
Co-ed: "No, a cute engineer."

* * *

"Really, Bill, your argument with your wife was most amusing."
"Wasn't it though? When she threw the axe at me, I thought I'd split."

* * *

I shot an arrow into the air,
It fell to the earth, I know not where;
I lost ten of the things that way.

* * *

A patient in a lunatic ward insisted he was Adolf Hitler.
"Who gave you that name?" the doctor inquired.
"God gave it to me," said the patient.
"No I didn't," answered a voice from a neighboring bed.

* * *

Mail orderly at mail call: "Letter for Cdadwinszkeidnozsly."
Voice from rear of barracks: "What initial?"

ASTR . . .

(Continued from Page 20)

economic forces at work are all studied. Together with these academic studies, instruction in military science and tactics along with the inevitable drill are also a requirement to complete the men's thorough training.

And so it is upon arrival at basic, with their college training, they will find themselves equipped to handle more easily the further instruction given. The physical training encountered here will do much to alleviate the strain of basic. Already the boys have developed muscle in strenuous exercise so that they will be able to fit themselves into the routine of army life much easier.

Perhaps you will now understand, a little better, the life here of a 17-year-old boy in the Army Specialized Training Reserve.

Administration

The local A. S. T. R. Unit is a part of the 3652nd Service Unit, University of Illinois, whose commandant is Col. Leonard C. Sparks. Col. Sparks commands the entire unit. However, immediate control is exercised by the director of A. S. T. for the unit, Maj. William Kuger. It is Maj. Kuger who is in direct control of both the A. S. T. R.'s and the A. S. T. P.'s, it is he who is commander of the administration. Under Maj. Kuger, who is also a member of the classification board, functions the Personnel Office, which is in charge of Capt. McClintuck. Here records are kept and classification carried out. The classification officer, Capt. McClinon, and the University representative, Dean Griffith, coordinator of the A. S. T. program. This group decides the classification of all members of the unit. It is the board that dismisses those who fail to maintain the necessary scholastic standing.

For actual administration the unit is divided into two companies. Company I is commanded by Lt. Andrew Kaiser and Company II by First Lt. Frank A. Bridgewater.

The arrival of several hundred new trainees has necessitated the movement of 140 of the boys to Evans Hall. This barracks is now occupied by the men who are allowed only two terms. Lt. Bridgewater is in charge of Evans Hall while Lt. Kaiser still controls the barracks at Newman Hall.

A. S. C. E.

Gathered together for its second meeting of the new semester, the Student Branch of the A. S. C. E. got well on its way into a new schedule. The gathering, held in room 319 Engineering Hall, was called to give the members an opportunity to view the slide films on the Golden Gate bridge. Professor Vawter, the co-author of one of the country's most outstanding books on structures, made the films more vivid with his interesting comments about the details of construction. Particularly interesting about the slides was the fact that one of the top men who engineered the Golden Gate bridge was a graduate of the University of Illinois.

All those students in the Civil, Architectural, or General Engineering departments who are not members of A. S. C. E., and would be interested in attending some of the meetings, are cordially invited to do so. Notice of all meetings is posted on the C. E. bulletin board on the second floor of Engineering hall.

ARMY SANITARY ENGINEERS

By WALTER C. BOYER, ASTP

The Spark of Army Specialized Training (A. S. T. P.) is being kept alive on the Illinois campus by a small group of Sanitary Engineering students now in residence for a period of six months. They had been ordered to report to the University following Infantry Basic Training at various I. R. T. C. Camps in the South. The contrast of life at Illinois to that of a Service Camp is quite striking and all are quick to agree "that heaven must be something like this." Some information concerning the background of these men is in order. The average age of the group is twenty-three years. All are former University men, a majority of them coming from institutions in the eastern part of the country. Willam Wardle, Benjamin Marcin, Frank Lucas are the Carnegie Tech representatives. Charles Morse is Worcester Polytechnic's favorite son. Harvard's Guido Ianctoliquido and Rhode Island State's John Chiaverini are prominent members of his "outfit." Adolph Bonin and Bernard Gerber represent the College of the city of New York. The University of Pittsburgh's football team has contributed Robert Steytler. Charles Schaffner proves residence at Cooper Union and Polytechnic Institute of Brooklyn. New York's own Manhattan College has graciously sent one of her most illustrious scholars and tumbling star, John Stak. Frank Loguidice is a Syracuse University man and Sidney Greller is a graduate of the Drexel Institute of Technology. Maryland has contributed James Stamer of the University of Maryland and Walter Boyer of the Johns Hopkins University. Rounding out the Eastern contingent is William

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PERSONALITIES . . .

(Continued from Page 22)

has taken advantage of his V-12 opportunities and has made many new friends. In the earlier days of V-12, he was considered as one of the best "consulting engineers"!

During his junior year, the rewards of diligent work began to roll in, the first of which was an invitatiion to join Tau Beta Pi, all engineering honorary fraternity. Later that year, John was asked to join Phi Lambda Upsilon, an honorary chemistry society. During his senior year, John has joined Sigma Tau, honorary engineering fraternity, and Alpha Chi Sigma, professional fraternity. He has also been active in the A. I. C. E., being president the first semester of his senior year.

John's future is necessarily uncertain. However, he has tentative plans of returning to the University of Illinois to do graduate work. After that he hopes to do development or pilot plant work in industry. Upon graduation John will be sent to midshipman's school. He hopes to become an engineering officer and then serve his assignment in the Navy.

WILLIAM O. FREY

A member of the Navy V-12 Unit since its beginning, Bill comes from Bloomington and Illinois Wesleyan University, where he was a member of Phi Gamma Delta, social fraternity. Most of you probably know him as the likeable young fellow with that "short" crew haircut.

An out-door man, Bill is very interested in hunting and trap shooting. In the latter, he has an eye keen enough to warrant participation in the national matches at Camp Perry in 1939. Perhaps it was his love of the out-door activities that led him to choose to become a civil engineer. True to Navy form, Bill is engaged, to a Sigma Kappa from Illinois Wesleyan University.

Academically, Bill is carrying on with a good average he made at Wesleyan. Besides keeping up that average, he has found time to become president of Chi Epsilon, honorary Civil Engineering fraternity and vice-president of Tau Beta Pi, all-engineering scholastic fraternity. In addition, he is a member of the student branch of the American Society of Civil Engineers, and hopes to receive a degree in that field when he cmpletes his work in the local V-12 unit.

Skidding is the action
When friction is a fraction
Of the vertical reaction
Which won't result in traction.

* * * *

"Do you like smoking jackets?"
"Don't know, never smoked one."

* * * *

Prof.: "Wake that fellow up beside you."
Student: "You do it, Prof. You put him to sleep."

* * * *

WPA Executive: If we don't figure out a way to spend that one hundred and twenty million dollars, we lose our jobs!

Secretary: How about a bridge over the Mississippi—lengthwise?

SANITARY ENGINEERS . . .

(Continued from Page 24)

Walker from Pennsylvania State University, the "grand old man of A. S. T." The Solid South is represented by Claude Griffin of the Virginia Polytechnic Institute and William Alexander from the University of Texas. Norman Flaigg is from the South Dakota State School of Mines and Khalil Budge is a former student of Utah State College. The "two Lloyds," Weller and Gebhart, are both from Kansas State College and James Zoller is late of Cornell University and the University of Wyoming. The immediate vicinity is represented by Maurice Richmond of Michigan State College and Edward Baumann of the University of Michigan who enthusiastically reports to each that he is the only bonafide member of the "Big Ten." Notre Dame University has gladly sent its James Warren. Visitors to Newman Hall will note a service flag in the window of Room 125 honoring the one member of the original group, Arnold Fisch, who has left the program on extended leave to serve as an ensign in the Navy.

One of the intentions of this article is to clear up a misapprehension which normally exists among laymen. The Sanitary Engineer in the Army is usually thought of as the individual who follows the Cavalry. It is hoped that an appraisal of the program will prove that this is only one of his many accomplishments. The Sanitary Engineers are now in Term T which consists of 29 class hours in various phases of the field. The courses taken in this term are: Treatment of Water, 6 hours; Hydrology and Drainage, 3 hours; Sanitary Bacteriology, 5 hours; Sanitary Chemistry, 6 hours, and General Sanitation, 3 hours. These courses are intended to approximate the sanitary option in Civil Engineering and at the completion of the seventh term a student is trained for service with the Corps of Engineers or for study in term eight. It is expected that all of the group will remain for study in term eight. This term consists of 29 hours in courses of instruction in public health engineering. The courses taken in the eighth term are: Parsitology, 6 hours; Sanitary Conference, 2 hours; Advance Sanitation, 4 hours; Epidemology, 3 hours; Advanced Sanitation Laboratory, 6 hours, and Advanced Sanitary Bacteriology, 6 hours.

A student completing the prescribed courses of study should have a knowledge of the production and treatment of water of a satisfactory quality. He should realize the causes of stream pollution and the theory of self purification. The design of sewage treatment works and the disposal of industrial waste are included in the course in Sewage treatment. The student should have a sound knowledge of the principles of public health engineering and the promotion of general sanitation including the menace of insects and animals as carriers of disease. The range of communicable diseases to be investigated include typhoid fever, amoebic dysentery, food poisoning, trichinosis, undulant fever, streptococcus infections, diphtheria, small pox, meningococcus meningitis, acute respiratory infections, typhus, and plague. The bactenological and micro-biologica techniques in Sanitary Control are brought within the scope of the student. Upon completion of this course of study the trainees are qualified for service with the Sanitary Division of the Medical Corps.

In addition the courses previously listed physical training and military instruction as a regular part of the program. The unit now rates the "Quasi-Purple Heart of Physical Training with an Oak Leaf Cluster" since two of its members have already become term disabilities.

The Sanitary Engineer of the Army Specialized Training Program wish to go on record as stating that what they have seen of the University of Illinois and its School of Engineering they like immensely, and it is hoped that the University and its personnel share a mutual feeling for them.

ASTP MARCH DOWN ILLINOIS BROADWALK

TECHNOCRACKS . . .

Mrs. B. M.: "Does your husband talk in his sleep?"
Mrs. M. M.: "No, and it's awfully exasperating. He only smiles."

* * * *

He: "Do you believe kissing is unhealthy?"
She: "I couldn't say—I've never—
He: "You've never been kissed?
She: "I've never been sick."

* * * *

Joe: "Have you got a picture of yourself?"
Roommate: "Yeh."
Joe: "Then let me use that mirror. I want to shave."

* * * *

Prison Warden: "I've had charge of this prison for ten years. We're going to celebrate. What kind of a party do you boys suggest?"
Prisoners: "Open House."

* * * *

Likes a kiss, but seldom Krs.
She's not amiss, but just a Mrs.
He, unkissed, so seldom Kr.
That he missed her .Mr.! Mr.!

* * * *

An actor who was married recently for the third time, and whose bride had been married once before, wrote across the bottom of the wedding invitations: "Be sure and come: this is no amateur performance."

* * * *

A lunatic was trying to knock a nail into a wall. But he had the head of the nail against the wood and was hammering at the point.

At length he threw down the nail in disgust and said, "Bah! Idiots! They give me a nail with the head on the wrong end."

Another inmate of the asylum who had been watching began to laugh.

"It's you that's the idiot," he said, as he jerked his thumb toward the opposite wall. "Nail was made for the other side of the room."

* * * *

I'm all done with dames,
They cheat and they lie;
They prey on us males
To the day that we die.
They tease and torment us
And drive us to sin—
Say—look at the blonde
That's just breeed in!

* * * *

"I've never been kissed before," she said, as she shifted the gear again with her knee.

* * * *

Taxi driver: "I take the next turn, don't I?"
Blum from read seat: "Oh, yeah?"

* * * *

First coed: "First it was love. He fascinated me and I kissed him."
Second coed: "Yeah, I know. Then he began to unfascinate you and you slapped him."

One Sunday evening a mechanical engineer had taken his best girl to church. When the collection was being taken up the young man explored his pockets and finding nothing whispered to his girl: "I haven't a cent, I changed my pants." Meanwhile his girl searching her bag and finding nothing blushed rosy red and said: "I'm in the same predicament."

* * * *

We noticed the following on a poster advertising a school dance:

"Girls may attend this dance, but no dresses are to be worn above the knees."

W tried to get tickets, but none were to be had.

* * * *

"Mary had a little swing,
It wasn't hard to find;
For everywhere that Mary went,
The swing was just behind."

* * * *

Mother is the necessity of convention.

* * * *

Mary: "Went out with a basketball player last night."
Ann: "In what position does he play?"
Mary: "Think I'd tell?"

* * * *

What do they mean by the eternal war between blondes and brunettes?
Chemical warfare.

* * * *

Willie put his baby brother
In the ice-box. When his mother
Found the little darling there,
He'd become a frigid heir.

* * * *

AND SO IT WAS

The hall was dark. I heard
The rustle of a skirt.
"Ha! Ha!" thought I, "I catch
You now, my little flirt."

Softly I sallied forth,
Resolved, when I had kissed her,
That I'd make her believe
I thought it was my sister.

The deed was done. Oh bliss!
Could any man resist her?
Apology was made—
Alas! It was my sister!

* * * *

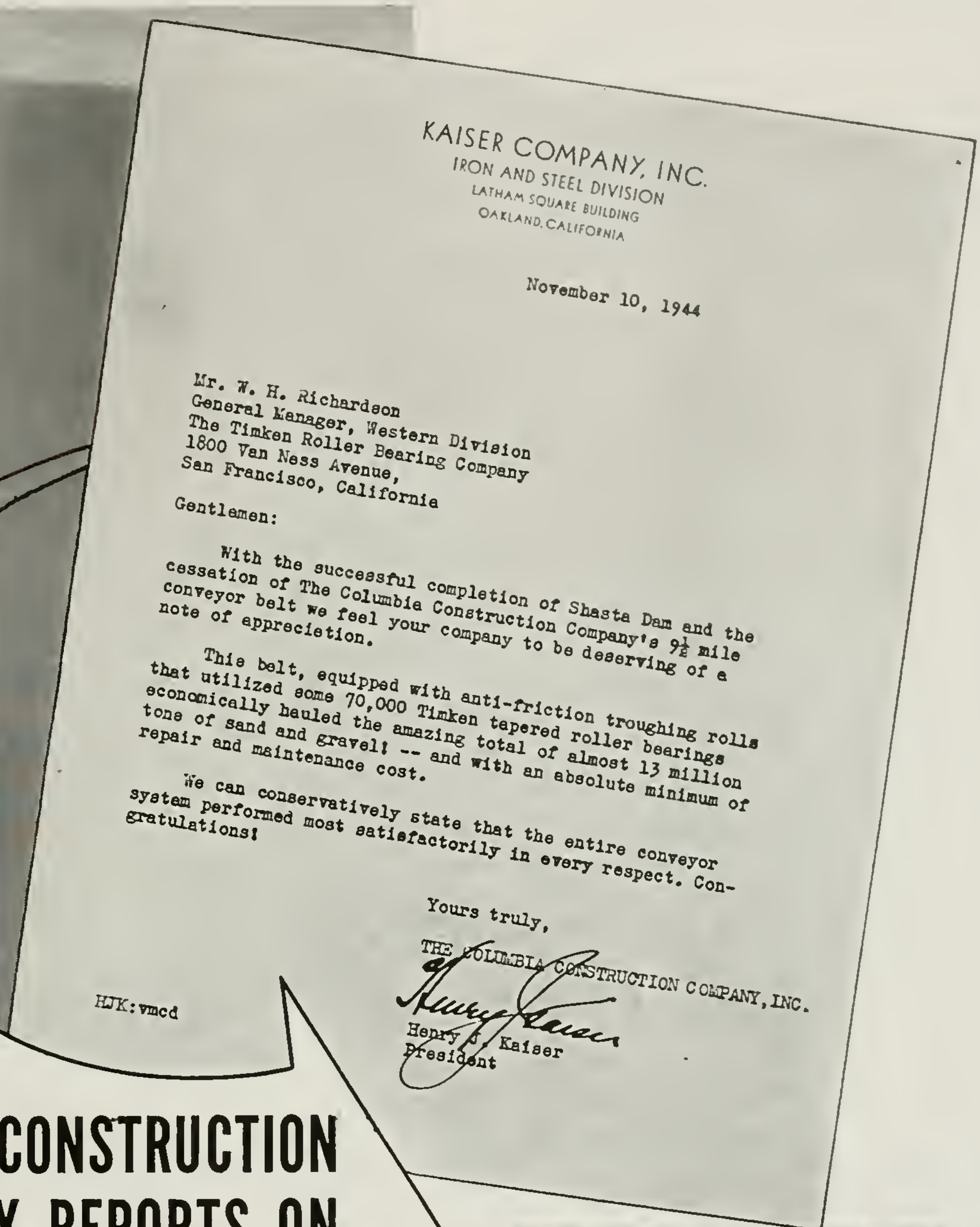
WANT AD: For trade—One IES study lamp for good bed. Am transferring from Engineering to L.A.S.

* * * *

He: "Gosh it's dark in this parlor; I can't even see my hand in front of me."
She: "That's all right, I know where it is."

* * * *

"What kind of a dress did Betty wear to the party last night?"
"I don't know, but I think it was checked."
"Boy, that must have been some party."
He: "Here's how."
She: "Say when—I know how!"



KAISER COMPANY, INC.
IRON AND STEEL DIVISION
LATHAM SQUARE BUILDING
OAKLAND, CALIFORNIA

November 10, 1944

Mr. W. H. Richardson
General Manager, Western Division
The Timken Roller Bearing Company
1800 Van Ness Avenue,
San Francisco, California

Gentlemen:

With the successful completion of Shasta Dam and the cessation of The Columbia Construction Company's 9½ mile conveyor belt we feel your company to be deserving of a note of appreciation.

This belt, equipped with anti-friction troughing rolls that utilized some 70,000 Timken tapered roller bearings economically hauled the amazing total of almost 13 million tons of sand and gravel! -- and with an absolute minimum of repair and maintenance cost.

We can conservatively state that the entire conveyor system performed most satisfactorily in every respect. Congratulations!

Yours truly,

THE COLUMBIA CONSTRUCTION COMPANY, INC.

Henry J. Kaiser
President

HJK:vmcd

THE COLUMBIA CONSTRUCTION COMPANY REPORTS ON TIMKEN BEARINGS AT SHASTA DAM

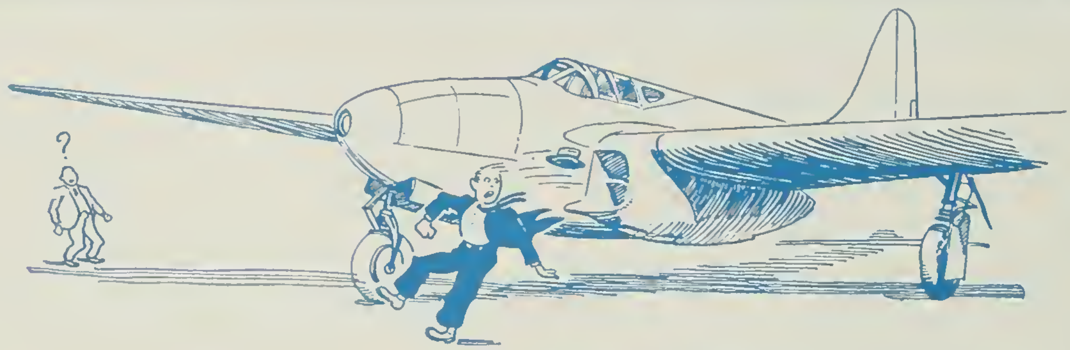
Timken Bearing Equipped Conveyors manufactured by Chain Belt Company, Milwaukee, Wis.

TIMKEN
TRADE MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD



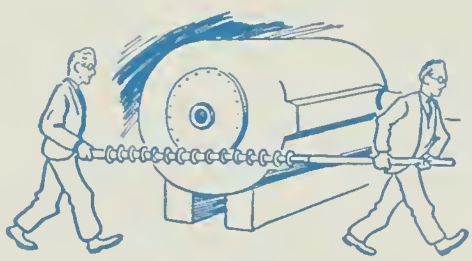
JET PROPULSION

QUICK on the take-off, prompt in answering the throttle, the jet-propelled plane has perhaps opened a revolutionary chapter in aviation. The P-59A Airacomet, built by Bell Aircraft, is the first American version—a single-seater, high-altitude fighter.

The engines were developed by General Electric from an original British design. The AAF assigned the job in 1941, and six months later the first jet engine in America, an aircraft gas turbine, was on test.

There's no propeller—reaction to a high velocity discharge of gases drives the plane forward. It's a practical application of Newton's law that "to every action there's an equal and opposite reaction."

The engine has only one main moving part. Air is taken into the engine, compressed, and after its temperature is increased by burning fuel, hot gases are discharged through a tailpipe nozzle. When these gases push in one direction, the plane moves in the other.



GIANT

THE new two million-volt X ray is the first one that can penetrate twelve inches of steel, and it can radiograph eight inches of steel 78 times as fast as the powerful million-volt units now on war jobs.

High voltage is supplied by a resonance transformer, a development of General Electric. Unlike the usual transformer, this has no iron core, and the X-ray tube is placed at its axis.

Since the new unit is strong enough to operate something like three feet away from the object, defects show on the film (behind the steel) in their actual size.

PHYSICS PLUS--

FOR a successful career in industrial physics a lot depends on a good background in English and chemistry. At least that's the opinion of Dr. Saul Dushman, assistant director of the G-E Research Laboratory.

This doesn't mean that a physicist has to be a "wielder of $64 words" or an orator on the side, but he'll go farther and get along better if he knows how to express himself clearly and correctly in his own language. And because he'll be working with newer and more complex materials, he'd better take chemistry too, says Dr. Dushman—all he can get. *General Electric Company, Schenectady 5, New York.*

Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

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GENERAL ELECTRIC

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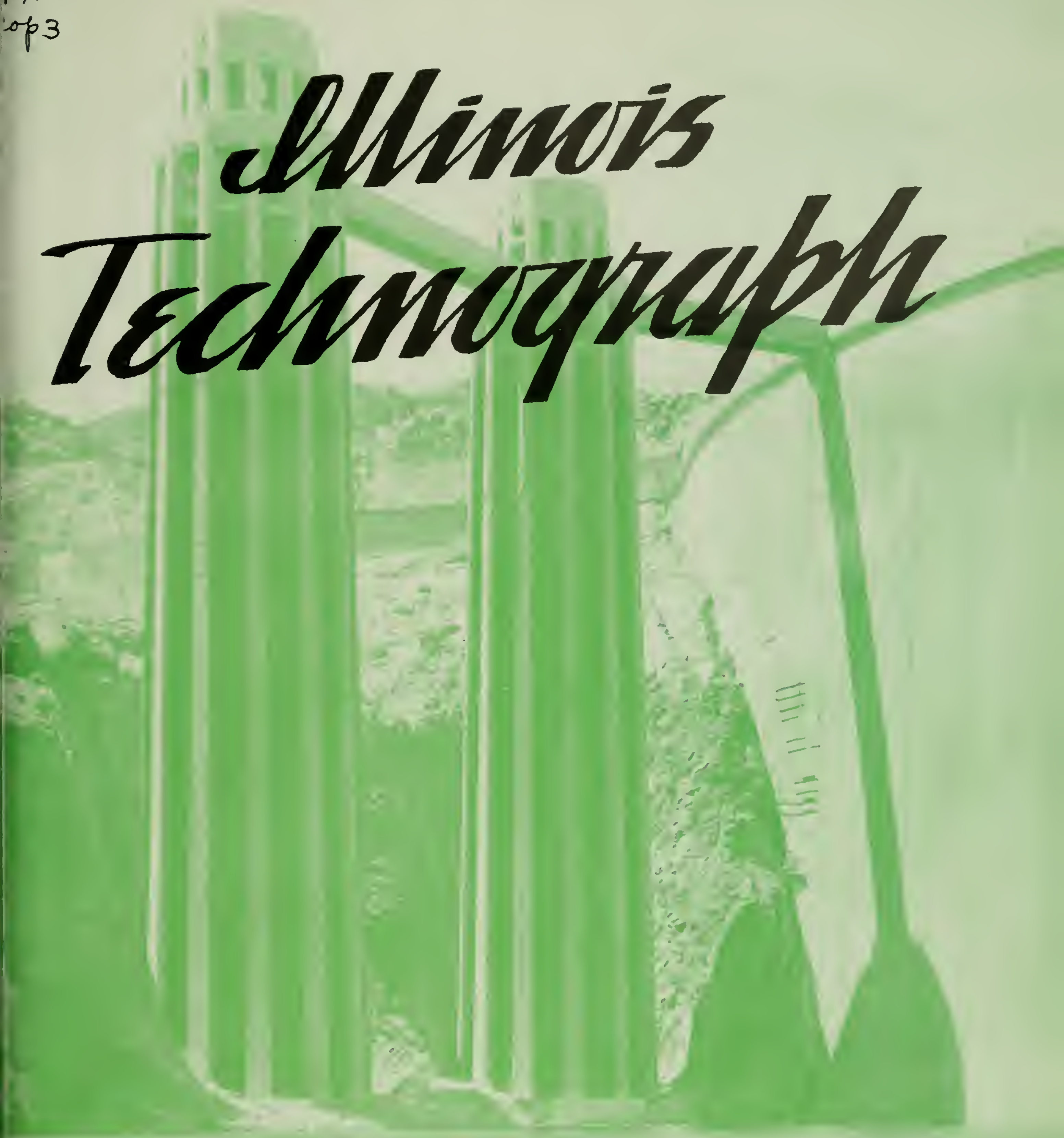
Illinois Technograph



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February, 1945 20 Cents

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The Tech Presents

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COVER—Shown on the cover are two of the intake towers at Boulder Dam. A total of four towers 395 feet high provide for the release of the water from the reservoir under normal conditions.

FRONTISPIECE—Shown on the frontispiece is an M-1 smoke-drake, a mechanical dragon which spouts smoke screens from its ten steel nostrils, gliding through waters of the English channel to cover transport ships from enemy observation. The M-1 smoke generator is mounted on an amphibious "duck." Signal Corps Photo.

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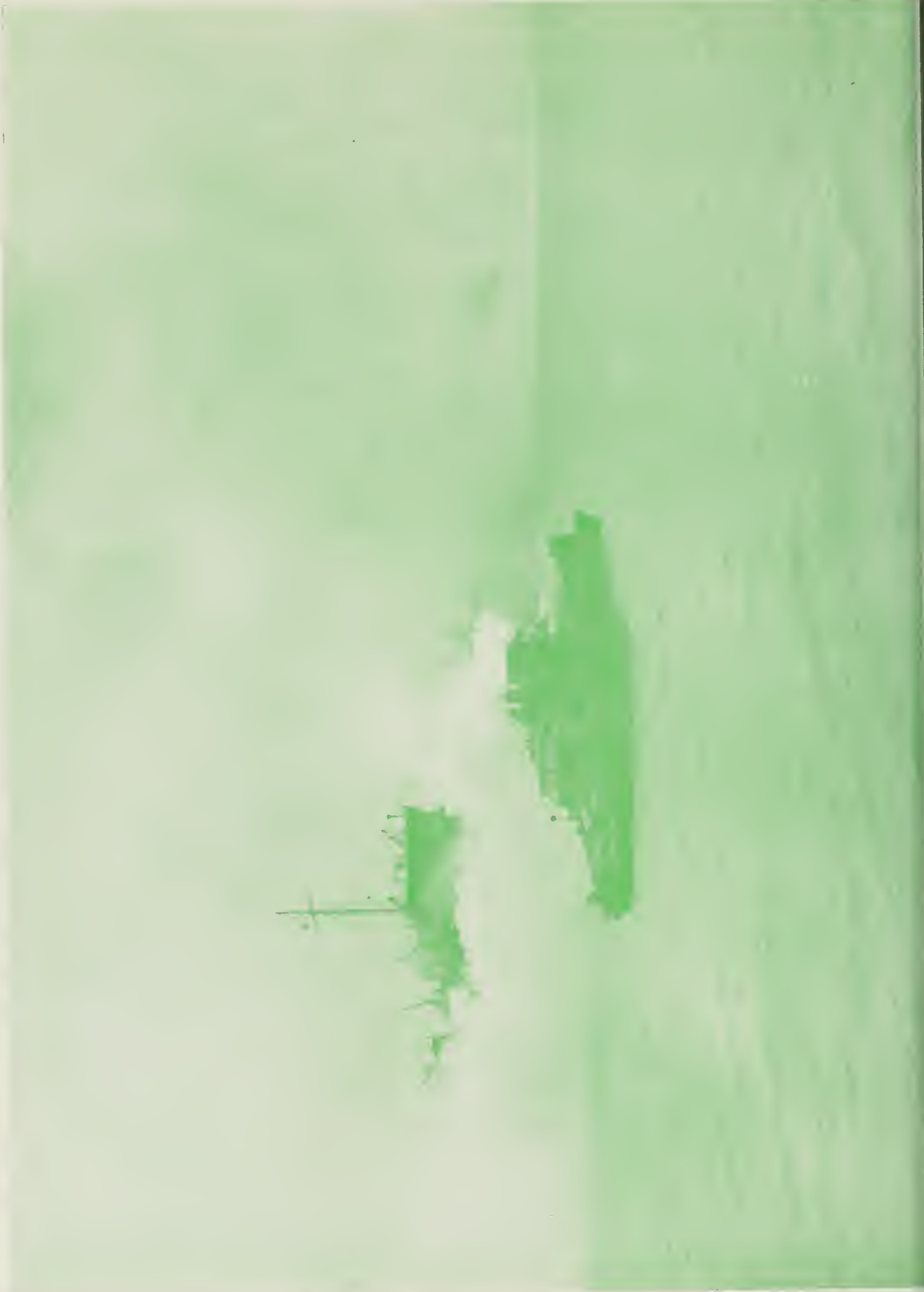


Illinois V-12 "Navy"

By BERT J. LEVEY, C.E. '46, V-12

When the Navy opened its doors to sailor men classified in V-12, it admitted the men to one of the most beneficial and useful schools, for both the war effort and individual achievement, that could have been set up during the national emergency. The advantages received from training in the V-12 program are important not only for the primary purpose of war-time officer production, but for the well-trained group that will be needed for peace time.

It is not the purpose of this article, however, to discuss the many opportunities offered the trainee, but rather to let the reader know a little more about the men and their activities in this program. It will give the reader a chance to see what has happened to these men from the beginning of the program to the present time, almost two years later. Each institution of learning where there is a V-12 program is, of course, a "Navy" all of its own. Usually, the layout of regulations and the minor details of the various schools differ in slight ways, but in the final outline of training, it may be said that all specifications are the same.

The University of Illinois unit, located in the Ninth Naval District, is typical of any V-12 unit. Many times cited for the excellent manner in which it is carrying out the program, it could easily be taken as a typical example since its beginning on July 1, 1943.

There were three main channels of entrance into V-12 in 1943. The first was that taken by high school students. It consisted of a qualifying mental examination coupled with a more-than-rigid physical examination. An interview with two naval officers was the last immediate test that the high school student had to pass. Some of the qualified high school students, who were registered with their draft boards, then had to volunteer for induction; and with their prerequisite for V-12, they were sworn into the Navy. Once members of the Navy, they were assigned to a V-12 unit. Prospective candidates who were not of draft age enlisted immediately in the Navy.

College men who were in some other "V" program had the second passage way into V-12. They were notified by the Navy that they automatically would be transferred into V-12 by a certain date. If the individual did not want to accept this reassignment, he was given his discharge from the Navy.

Many enlisted men also had an opportunity to qualify for V-12. Their requirements, for the most part, were of a little different nature than those of the first two groups. They had to have a perfectly clear Navy record, a high rate of personal performance, exceptional officer-like qualities, and innumerable other qualities that only the Navy can judge.

These were the main doors that led to V-12. And as the quotas were changed, some of these were locked to men that desired entrance. The only portal that has always been kept open is the one leading from the fleet.

Many of the men who entered the University of Illinois Navy V-12 Unit in July, 1943, were new to the Navy. A large group which boarded the same south-bound train in Chicago are, perhaps, typical of those new trainees. On the train it wasn't hard to distinguish the new trainees for although they were gathered from every far corner of the country, they all had the sound appearance of having passed the same rigorous standards. It was these men that jammed the train. And it was these same Navy men making friends with the fellows next to them, playing cards, chatting, and mingling with the usual cross section of orange eaters and baby carriers, who kept a perpetual excited hum running through the cars. But no one seemed to mind, for there was something new to look forward to, something that they had never known before. It wasn't long, however, until even the expectation of something new grew tiresome, along with the Illinois countryside, and the boys' busy hum died out. The swirling soot that drifted into the cars also helped to harden the reality of the journey, and soon only the taint of oranges and the loud metallic clicks of the cars jiggling together filled the air. Hour after hour passed this way until the conductor paced through the crowded cars calling everyone's attention to the fact that Champaign was the next stop. Immediately the hubbub of noise again arose, for it wasn't hard to excite the spirit of this group of men—yes, young apprentice sailor men who were eager to start something that had never been tried before.

On the campus, the men gathered at the Women's Gym-

Main Entrance, V-12 Dormitories

nasium. It was here that most of the group first became acquainted with the real Navy, for in the middle of the afternoon, two Navy chief petty officers took charge and brought order among the large group of restless men. The chiefs then issued bedding, assigned rooms, and in general started the men on their way in Navy life.

Surveying Class

The trainees were assigned to reside in one of three residence halls—Evans and Busey, which are twin halls located near the Women's Gymnasium (this was later referred to as "Navy Gym"), and Illini Hall, which is situated on the other side of the campus. The men who were ordered to Evans and Busey ate their meals in the convenient dining hall located in the basement, which connects the two buildings; and the men of Illini Hall were served their meals in the Illini Union Building. About a year after the unit started, however, all the V-12's ate at Evans and Busey.

The administration of the 450 men that first made up

Practicing

the unit was, in itself, a unique job. The entire unit is known as a battalion, and for convenience, the battalion was broken down into four companies. Each company, in turn, was divided into four platoons. Approximately thirty men made up one platoon. The lowest man in the responsibility chain for administration is the platoon leader. He must report to the company commander, who in turn is responsible to the chief petty officer. The chief is the highest official in the chain of non-commissioned officers in the V-12 organization. The chief is responsible to the commanding officer who in turn receives his orders from the Bureau of Personnel in Washington. This completes the official chain of command. But for adequate organization in a unit of this size, other provisions must also be made.

There are several smaller departments of organization which are no less important than the command group. The medical and dental departments take care of the health of the men. If a man gets sick, needs innoculations, or has dental trouble, he can immediately go to the "sick bay" where he receives the finest treatment the Navy has to offer. The medical department is headed by the doctors, who rank from lieutenant (jg) upward. The doctors have as

Captain's Inspection

their assistants, corps men who rank down from chief pharmacist's mates to first, second, and third class mates. The dispersing office is similarly attended. An officer heads a group of busy store keepers who issue the men clothing and other essentials. They also pay the men. Another of the important departments in the administrative branch is that filled by yeomen. They attend to all the office work. Usually a chief is the top man in this organization, and by coordinating these different departments into one administrative power, the work of running the V-12 unit is carried out.

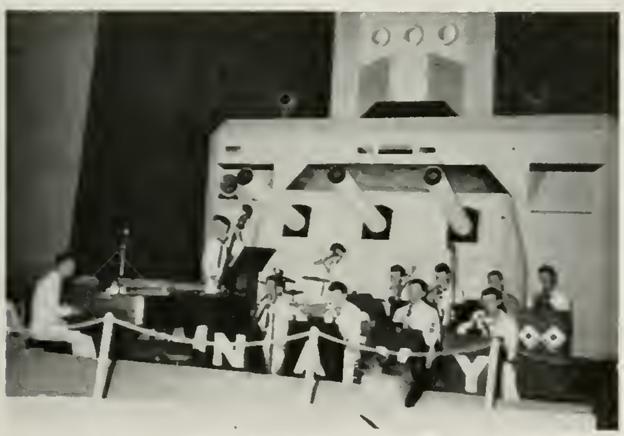
Most of the men who first came into V-12 were either from other college "V" programs or from the nation's high schools, and to arrange these men with suitable programs was a difficult job. The Navy classified them by the amount of college training they had previously received. Men who already had at least sixteen weeks of college work, any time before they entered V-12, were allowed to continue in the course of their choice as long as they met Navy requirements. However, the sailors who had had no college work before their entrance into V-12 had to fulfill certain requirements before they were allowed to proceed in a definite course of training, and they were placd in the different classifications for which they were best suited. They were first given two semesters of basic freshman courses. Their scholastic records from these two terms, their grades from a seven-hour mental examination, and their Navy records, were used to screen the beginners.

The sailor being screened had the opportunity to request the branch of training that he would best like to follow. He was given the privilege of selecting any three in the order that they appealed to him. If the Navy thought the trainee qualified, and if there was an opening, it was almost assured that the sailor would receive his preference.

Some of the branches of the Navy and Marine Corps that were open to the trainees were engineering, supply, deck, medical, air corps, and Naval Reserve Officer Training Corps. The engineering field included such divisions as civil, electrical, general, mechanical, and aeronautical. Not all of these branches, however, require the same number of semesters for completion. Most engineering courses require eight semesters, N.R.O.T.C. takes seven semesters, and deck school retains the trainees only four semesters. Upon completion of the required number of semesters, the sailor is sent to a midshipman's school where he receives four months of Naval indoctrination after finishing this training, the man is commissioned an ensign in the United States Naval Reserve.

When the new group of sailors first lived in Evans, Busey, and Illini halls, their activities were restricted very little. As long as the trainee kept up his scholastic record, there were very few restrictions on his time. The Navy had arranged the program in such a manner that the sailor could participate in any university activity as long as it did not interfere with his primary purpose of being a trainee. There were all night study hours and only two musters a day that the sailor had to meet. One roll call was at 0600 for early morning calisthenics, and the other was at 0730 for announcements and inspection before the sailor went to classes each morning. The rest of the day was devoted to class work and what ever else the trainee found to interest himself.

The Navy required the sailor to take three semesters, each sixteen weeks long, a year. And each semester the trainee carried no less than nineteen hours of college work. Naturally, this part of the program has never changed. But as time went by, each new commander who had charge of the unit would add his own restrictions to the life of the men until the unit became a truly sharp piece of Naval organization, and the trainee became more hedged in by Navy regulations.



Navy Dance

The unit no longer lives in Evans, Busey, and Illini Hall. It has moved into the Men's Residence Halls, three of the most modern halls on campus. The quota has been cut down until now there are only 336 men left in the battalion. Of this number, 320 are engineers, 10 are pre-meds, and 6 are in the basic program. They are divided into four companies, each of which has only three platoons. The training of the engineer and the pre-medical sailor, however, is quite different. The engineer, usually, can complete his training at one school. Upon graduation from his course and indoctrination as a Naval offiver, the engineer is commissioned an ensign. But the medical sailor takes a different course to his commission. He must first complete a pre-medical course at college with grades which will assure acceptance by a medical school. This period of preparatory training usually requires four semesters of college work. The medic seaman is then transferred to a medical school that requires eight more semesters before graduation. The doctor then steps into a lieutenant's (jg) uniform after receiving his D.D.S. or M.D. degree. These are the two main routes followed by most of the trainees.

Dispersed among the unit, one out of every four sailors,

Canteen

are men that have served in the Navy some place other than in the V-12 unit. There are men in the battalion who have come from long distances, seen much action, and have given up as much as $125 a month to fulfill their hopes of becoming an officer. There are veterans who have been in the battles of Midway and Pearl Harbor. Many of these men were in Naval engagements in the Solomon Islands, Tulagi, Bougainville, Vella la Vella, and Guadalcanal. They have come from bases as far away as 10,500 miles and have been on every type of ship from the "battle-wagon" to repair tenders. There are a few of the men who have given up rates as high as first class petty officer.

"Nancy," Station Mascot

Others have relinquished title to second and third class petty officer ratings. Some of the men are "shellbacks," "short snorters," Seabees, and "soft shellbacks." Others were pharmacist's mates that made beach landings with the Marines and established field hospitals and aid stations.

In his conditioning for the position of Naval officer, there

(Continued on Page 22)

WHAT IS MATTER?

By WILLIAM VICUNUS, A.S.T.R.

The structure of the hydrogen atom is necessarily a matter of conjecture. Fortunately there is a great mass of data on which competent scientists may base their opinions. The primary purpose of studying the structure of the atom is to discover the ultimate structure of all matter in the universe. The hydrogen atom is taken as a beginning because it is, by far, the simplest of all elements.

To begin my discussion of atomic physics a general knowledge of atomic particles must be introduced. The atom, as we know it, consists essentially of a central, compact nucleus with an outer shell of electrons. The nucleus is extremely complex, containing many different particles about which comparitively little is known. A list of these atomic particles here would be of greater advantage than to explain each one as it comes up!

NAME	CHARGE	MASS IN RELATIVE ATOMIC UNITS
ELECTRON	-1	0.00055
POSITRON	+1	0.00055
PROTRON	+1	1.0076
NEGATRON	-1	1.0076
NEUTRON	0	1.0090
NEUTRINO	0	SMALL NEUTRON MASS UNKNOWN
MESOTRON	VARIABLE	VARIABLE

Atomic Particles

Of these, all are found in the nucleus except the electron, and the least is known about the mesotron and neutrino. A third group of interest in the atom is the energy group. Since the energy, when confined to the atom, has no mass it is then disregarded. But, on being released at speeds approaching that of light, its mass increases in relation to its energy as expressed by Einstein's equation:

$E=mc^2$. E=energy
m=mass
c=the speed of light (3×10^{10} cm sec)

These particles must be considered together with the more concrete examples which have mass at rest.

The nucleus of the hydrogen atom is simple compared with the other elements. It is composed mainly of a single proton. If, by chance (one part in six thousand), a neutron is present the isotope, or similar atom, is called deuterium. This proton accounts for almost all of the mass of the mass of the atom, which is approximately 1.008 atomic units. The radius of the nucleus is about 1×10^{-12} centimeters. That the hydrogen atom consists of one proton, and other elements contain more, would suggest that higher elements would have as weights simple multiples of 1.008. This is not true, however, and the explanation lies in the so-called packing effect. As the mass increases it is packed closer with the result that some of it is transformed into energy. This energy is the binding energy of the nuclear particle. In the case of the simple oxygen atom it is equivalent to 137 million electron volts. The atomic power of which one hears so much lies in this binding energy and ultimately in the energy equivalence of the mass.

The outer shell of the hydrogen atom consists of a single electron revolving about the central nucleus at an average radius of 1×10^{-8} centimeters. The electron itself has a mass which, because of its variable speed, varies greatly. The approximate value assigned to it is 0.00055 atomic units. The charge on the electron is opposite to that on the proton and equal to 4.8×10^{-10} electrostatic units. The fact that the electron is one of the ultimate particles of all matter is evide from the fact that they may be separated from all elements by heat or electrical forces. The first explanation of the atom in terms of its constituents by Lord Rutherford in 1912 pictured the electron in circular orbits about the nucleus. Later developments forced modifications including eliptical orbits and a variable number of these.

To consider the forces in the atom one must consider the two conventional forces of static and dynamic energy. Applying static forces of electricity it would be necessary for the unlike charges of the proton and electron to attract each other with an extremely large force because of their proximity. Since the atom does not collapse, these forces must be ruled out at least temporarily. By dynamic forces, the centrifugal forces of the moving electrons might balance the attractive forces between the electron and the nucleus. The catch in this argument is that, in order to balance the electrostatic forces, the electron must travel at impossible speeds. Also the observed emission of energy would disrupt the equilibrium. What has just been said may be summed up in three statements:

"1. The forces can not be purely repulsive.

"2. There must be attractive forces, but there must also be antagonists to them.

"3. These forces can not be due solely to attraction of gravity and magnetism and counterbalanced by motion."

Because of these observations it was seen that new forces or new concepts of old forces must be derived.

When hydrogen gas is ionized in an electrical field it loses its electrons and acquires a greenish glow. If this light is analyzed with a spectroscope a series of bright lines are observed against a black background. These lines would be hard to interpret were it not for the quantum theory. This important contribution to physics was formulated by Max Planck, formery Professor of Theoretical Physics at the University of Berlin. The essential concept of this theory is that energy is emitted in compact particles called photons or quanta which travel away in vibratory motion with energy that varies as the frequency of the radiation. This relationship is given by Planck's equation.

$$E=hv=h(c/l)$$

E=energy
h=Planck's constant (6.55×10^{-27} erg-seconds)
v=frequency
c=the speed of light
l=the wave length

Applying this new concept to the hydrogen spectra it was discovered that each bright line corresponded to a certain energy, and that these energies had certain fixed levels with no intermediate values. This experimental trial seemed to uphold the quantum theory in that radiation is not continuous but intermittent, and also it helped to explain the action of the hydrogen atom. The fact that there are several lines in the hydrogen spectra suggests that there are several energy states in the stable atom. Bohr, who developed this theory mathematically, accounts to this phenomenon the reason for the static stability of the atom. There may be any number of these so called stationary states which correspond to different energy levels and occur at different radi from the nucleus. In order to change from one level to another the electron must release energy in a bundle to move farther away and absorb energy in a bundle in order to move closer. The values for the energy levels of the hydrogen atom may be calculated approximately by the formula

$$E=(-13.54\ Z)/N$$

E=energy
Z=charge on the proton
N=quantum number

Ionization may occur from any of these states and thus one observes the different lines in the spectra. Bohr discovered the equation for the frequency of radiation corresponding to the spectral lines to be

$$V = Z^2 R \left(\frac{1}{N_2^2} - \frac{1}{N_1^2}\right)$$

V= frequency
Z=atomic number
R=Rhydberg's constant
N_2=Final Energy Level
N_1=Initial Energy Level

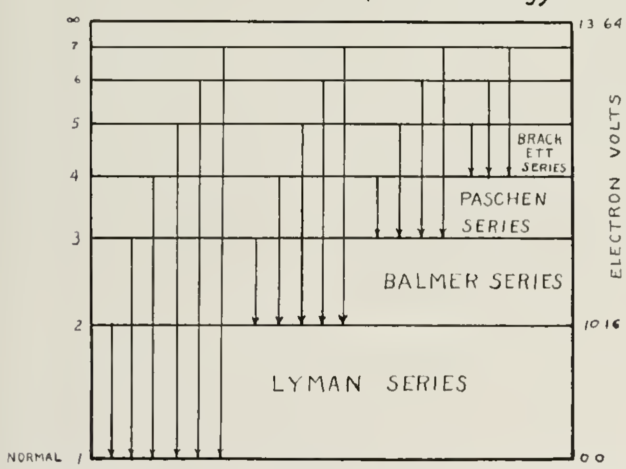
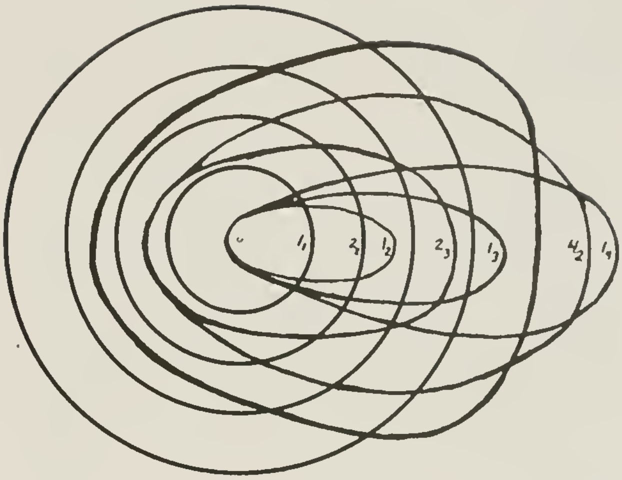


Diagram of Potential Energy States for Hydrogen Atom

Further complications were encountered when better spectroscoy revealed that each line was composed of a number of finer lines. A modification of the Bohr picture by Sommerfeld showed that these new lines could be explained by assigning azimuthal qualifications to the original states. These new orbitals took on elliptical shapes, and, because of varying radius of curvature, they maintained a constantly varying energy of rotation. This fact could be used to explain the slight differences in ionization potential. The azimuthal states of the hydrogen may be pictured roughly as follows



Model of the stationary quanta state of the Hydrogen Atom showing Bohr-Sommerfeld principal Quantum and Azimuthal or auxiliary states.

These orbitals may be further modified by electrostatic attraction between the electrons in the higher elements.

To explain stability in the nucleus is much more difficult. The hydrogen atom with its single positive proton is relatively simple, but increasing the mass causes difficulties many of which are not fully explained now. With a nucleus of many protons and neutrons the like charges would repel each other with a subsequent explosion of the nucleus. The part that smaller nuclear particles play is not known exactly, but it is supposed that their influence must be great. The mesotron, just recently discovered, is perhaps the most important of these particles. Its variable mass and charge make it ideal for carrying exchange forces. These exchange forces originate when a particle which has been bound to another one escapes and attaches itself to another. An example is seen in the stable hydrogen molecule where an electron belonging to one atom may disengage itself and rotate for a moment about the other atom. The mesotron, as hypothesized, would act the part of the electron in the nucleus, carrying its mass and charge between larger particles. Each change of position entails a change of energy and this energy may be used to explain the stability of the nucleus. Because of the small masses and the small distances separating these particles the forces are very large.

I want to emphasize two facts in concluding. The material offered here is brief an dsubject to modifications at all times. The pictures are merely hypothetical since there can be no perfect representation of a particle the size of the atom. The advantage of a pictorial representation of an atom comes from the fact that it makes it easier to demonstrate physical and chemical phenomena. It is necessary, therefore, to attempt to portray the atom always keeping in mind the relative position between the hypothesis and data.

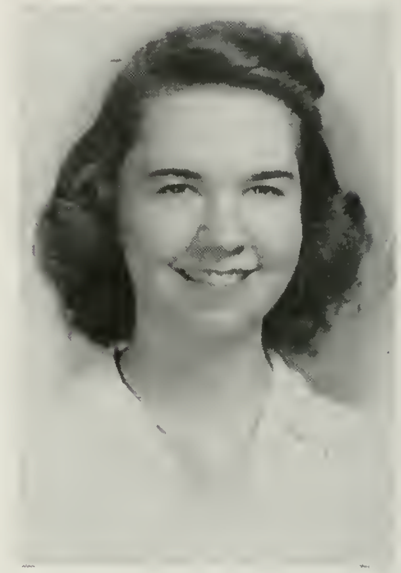
There is nothing strange about saying that the modern girl is a "live-wire." She carries practically no insulation.

Kay: "Women are fools to marry."
Shetlo: "Yes, of course, but who else is there for us to marry?"

Why take life so seriously? You'll never get out of it alive!"

On to the Future . . .

By ELIZABETH JANE FOSTER



This article by Miss Elizabeth Jane Foster was one of the four winning entries in the Science Essay Contest of 1943, sponsored by Westinghouse. This essay, written when she was a senior in Oak Park, Illinois, High School, won Miss Foster a scholarship and a trip to Washington, D. C. She is now a chemistry major here at Illinois. She teaches qualitative analysis and is learning how to operate the electron microscope.

Young students of today look forward into a world of political, economic and social unrest and uncertainty. The future is doubtful, the present unhappy, and the past cannot be viewed with much satisfaction. But although those of us who are scientists look forward into a future of scientific uncertainty, we do have behind us a background of careful observation, correlation of facts, formation of theories, and finally, discovery of many fundamental laws. These things are our heritage from the past, and we must use them to the best of our ability as a basis for building the future of science.

It has been in the past, as it must be in the future, the responsibility of the practical scientist to find new ways of utilizing scientific principles to benefit mankind. At the same time, new laws must be discovered which may later be used for man's welfare. The theoretical scientist, whether in the dingy alchemists' dens of centuries past or in the modern laboratories of today, has sought to answer three questions: "What is matter?" "What is energy?" "What is life?"

Scientists are beginning to realize that these questions and their answers are not unrelated as they first seem, but are closely interwoven. This recognition of scientific interconnection has been slow in arrival and slow in acceptance. We too, as young chemists, seek to find the origin of matter; as physicists, to discover the nature of energy; and as biologists, to uncover the mystery of life; but we realize that in order to make any great future scientific progress, we must cooperate more closely and effectively.

Courses now offered in biochemistry, biophysics, physical chemistry, and chemical physics are an indication that men of science recognize the relationships between the sciences. But still far too many chemists, physicists, and biologists study only their own particular interest in college, and upon graduation rush off to a laboratory, there to spend the rest of their lives in mentally pleasant chemical, physical, or biological isolation. Beneficial as this may have been a few centuries ago, it is so no longer. We have advanced far enough in science that we must recognize scientific relationships and treat them as such.

I was told that in German laboratories before the war, groups of men could be seen working together on the same problem, rather than each one working individually, as is generally seen in our own laboratories. They, then, had realized sooner than we the need for cooperation in science. The Germans are admittedly far ahead of us in knowledge of dietetics; perhaps if American scientists could see more clearly the extent to which cooperation is needed, and could recognize that there already is a certain amount of coefficiency, a more cooperative spirit would be built up which would result in further scientific progress in America.

Recent advancement in the field of cytology is a fascinating example of what may be done with scientific cooperation, and a promise of future progress to be made with the linking of chemistry, physics, and biology. Cytology is considered primarily a biological science. The cell is a unit of living protoplasm; it occurs either singly or with a group of other cells. But it has that peculiar property called life, a form of energy that man has not yet been able to control. For years life was considered to be the biologist's particular problem, until Wohler, a German chemist, in 1828 synthesized urea, a substance which was thought to be produced only by living matter. Since that time many organic compounds have been synthesized by man from inorganic materials.

The chemical composition of the cell has been determined fairly accurately by modern methods of chemical analysis. Often by analyzing a cell or its products, the scientist can tell more about its physiological function. Extensive research in colloid chemistry and osmosis has taught the scientist much about the physical nature of protoplasm.

The invention of the electron microscope, with magnifications of 67,000 diameters permitting enlargement to over 200,000 diameters, has been a great boon to the cytologist. Organisms and colloidal particles of the order of magnitude of large molecules have been seen. When the physicist first learned to "smash" atoms, little did he realize the great power he would sometime hold, not only the great source of atomic energy, but other ways of benefitting mankind. The electron microscope is a direct result of the ability of the physicist to utilize the electron, the particle of negative electricity. By using the same principle as the light microscope, only bombarding the specimen with electrons instead of light rays, the scientist has obtained great powers of magnification. The electron microscope has great possibilities for science. It is up to us young chemists, physicists, and biologists to discover them, and to use them for man's best welfare.

It may be possible later for us to see viruses, causes of some of our most dread diseases, such as infantile paralysis. Then we could see if these viruses are large molecules, as is thought by some, or more complex particles. We could watch them react with various compounds, and thus determine whether the virus, in its crystalline protein form, would react with some other non-living material to make living protoplasm. There man would have in his hands the first step toward creating life. It is altogether possible that crystalline, non-living virus plus some ensyme form was, millions of years past, the very origin of life. If man could discover this secret which Nature has kept hidden for so long, he would have a source of energy comparable with the

(Continued on Page 26)

Meet the . . .

"SKIPPER"

By BERT J. LEVEY
C.E. '46, V-12

★

ARTHUR BLAKE

In command of the Naval V-12 unit at the University of Illinois, Lieutenant Arthur Blake has now completed one year of service at his present post. And in this year, this man has guided the unit through many changes and has, himself, valuably served the station in several capacities.

Lieutenant Blake arrived at the University of Illinois in April of 1944 to take over duties of officer-in-charge. He was transferred here from an instructor's duties at Colgate University, New York. It was in his home state of New York that the captain first received his experience in administration which now stands him in such good stead.

The captain was born and spent most of his life in Brooklyn. It was at New York University in 1922 that Captain Blake received a Bachelor of Commercial Science degree. He then went on to receive his Master's degree in finance at the same school. He also spent enough time at Fordham to secure a Master of Arts degree in education. Although the captain had played a great deal of football and was captain of his high school team, his studies at college did not leave him enough time to continue in his athletic career. But his education did give him ample qualification for the important jobs he was later to hold in civilian and Navy life. He obtained a Certified Public Accountant degree from the state of New York, and although it is not generally known, this achievement is very difficult to attain.

Lieutenant Blake has worked for some of the largest commercial concerns of our country. He first started his public relations activity with the Cunard Steamship Company. He then went on to work for the Standard Oil Company of New Jersey; and a little later, he accepted a position with General Motors. This particular branch of work was with the Acceptance Corporation. Westinghouse was the last firm to employ Mr. Blake, and he spent six years with them before he went into business for himself.

After leaving the employ of the large corporations, Mr. Blake spent ten years as a public accountant. During this time, moreover, he also taught accounting in night schools at the Y.M.C.A. This gave him a professional interest in the capacity of teacher and in 1934 he took a full time teaching position in the New York school system. The captain spent most of his time as the Dean of Boys at the William Cullen Bryant school. He had charge of 2,000 boys at this time. It was in these years of teaching and practice that the captain gained much of his keen knowledge about human nature and how to handle men.

In the last war, the captain entered the Navy as an apprentice seaman. He qualified for an officer candidate school shortly after entrance into the service. He remained at the training school for ninety days, and then, at the end of this three-month period, he was sent to an indoctrination course on the old U.S.S. Granite State. This was one of the old full-rigged sailing vessels of the Navy. It just so happened, however, that before the newly commissioned ensign was assigned to a post, the war ended. But his experiences while he was an apprentice seaman and a cadet officer also gave the captain an understanding of the problems of what his men now have to face as they, too, train to become officers.

Lieutenant Blake first came to this base as a lieutenant (jg) and executive officer. After the invaluable way in which he handled the unit, giving it a distinct military bearing and making it one of the highest rated in the Ninth Naval District, the Bureau of Naval Personnel found it fit to make him captain of the station and advance his rank to full lieutenant. But now, since the N.R.O.T.C. is about to come to the campus of the University of Illinois, the captain feels that he will soon be relieved of his present assignment and sent to duty at sea. Some time ago, the captain had asked for duty as a deck officer, but the bureau kept him at this training center where his services were much more valuable. Now his hopes are for some good advanced naval base or to proceed with service training.

Many of the captain's hobbies are directly connected with his vocation. The work that the captain did at Colgate was concerned with the flying branch of the Navy and Marine Corps. For he holds a C.A.A. ground instructor's rating and he also has a diploma as ground instructor from the army air corps. This fascinating branch of study is still a favorite of the captain's, and in his much liked reading, he endeavors to keep abreast of the latest developments in air transportation. Another of the captain's favorite subjects for leisure reading is the past and present history of the United States. But above all, the Navy holds the tender spot in Lieutenant Blake's heart, for his greatest pleasure comes in his present work; making model boats, and just telling and listening to good old sea stories gives the captain his greatest enjoyment.

Lieutenant Blake, with his background of leadership and inter-public relations has acquired an enviable record for naval management in the V-12 program. He has proved to be an able guide and has shown the men many of the qualifications of officership that they will need in their days to come.

The Illinois Technograph Prize Essay Contest

for

High School Students

THE PRIZES

A one-year subscription to the Illinois Technograph and a week-end trip to the University campus, including the annual banquet of the Technograph Staff. (Places 1-5.)

A one-year subscription to the Illinois Technograph. (Places 6-15.)

Thousands of Technograph readers in the high schools of Illinois have had an opportunity to see what the magazine is trying to do. This year, good work has been done and mistakes have been made. You, our high school readers, now have an opportunity to help shape the future policy of the Technograph by taking part in this contest. Study the issues on your library shelves and then write a short essay on the following subject:

"If I Were Editor of The Technograph"

Tell what you like and do not like about the material and presentations, and give suggestions for improvement. Remember that the magazine exists for the mutual benefit of our engineering students, our faculty, our advertisers, and you.

THE RULES

1. All seniors, juniors, and sophomores, as of April 1, 1945, registered in an Illinois High School are eligible to compete. More than one may enter from a school.

2. The essays shall be under 250 words in length and confined to the subject, "If I were Editor of the Technograph."

3. Essays should be written or typed on one side of eight and one-half inch by eleven-inch paper. One copy only need be sent.

4. Entries should be sent to "Contest Editor, Illinois Technograph, 213 Engineering Hall, Urbana, Illinois," and must be postmarked not later than midnight, April 16, 1945.

5. Entries must not be marked with the name of the student or his school. Code numbers will be assigned before presentation to the judges. Each essay must be accompanied by the following statement on a separate sheet eight and one-half inches by eleven inches, preferably on official school stationery.

   I (full name) am a registered (senior, junior, sophomore) student

   at________________________High School of____________________Illinois. This contest entry is my own composition.

   *(Signed)*_______________________________________

   I certify that the above student is duly registered and in good standing

   at_____________________________________High School.

   *(Signed)*_______________________________________
   Teacher or Principal (state which)

6. Entries will be judged on the basis of content, neatness, and composition. The judges' decision will be final. They are:
   John A. Henry, Department of Mechanical Engineering, Frank E. Schooley, School of Journalism, Charles W. Roberts, Department of English.

7. The Technograph reserves the right to publish any or all essays submitted.

8. Prize winners will be announced in the May issue of the Technograph.

9. Transportation, meals, entertainment, and approved housing for the first five prize winners will be furnished by the Technograph. The date of the campus trip is tentatively set for May 18-20, the dates of the State Interscholastic Track Meet and a University Baseball game.

Melvin E. Long, *Editor*
Frank R. Holecek, *Business Manager*

OUTSTANDING *student*

By FRANK HOLECEK, M.E. '45, V-12

Not long ago Mr. Starr of the machine tool lab received rough castings of a miniature five cylinder radial aircraft engine and presented it for inspection to his students. With typical engineering enthusiasm, they peered upon this marvel of workmanship—but to one in the group it was more than just an enthusiasm—it was his hopes, dreams, and desires. With glittering eyes, Bob Hayes noticed each minor intricacy, observed the tiny pistons and valves and was carried away into a world of his own. This world of his is one built around aviation—what it is and what it will be.

BOB HAYES

Perhaps this secret love of his began when he served as an Aviation Machinist's Mate at a Naval Air Station, but it seems certain that this love of delicate machinery dates back farther than that. Back in 1939, Bob graduated from high school and sought his fortune in industry at the National Carbon Company as a general assistant. He learned the business of engineering from the bottom up. First he did blue print work, then he became the photostat operator, later drafting detailer, and finally tool designer. Not content with this slow method of learning, Bob sought the theory behind his work at Fenn Evening College in Cleveland, Ohio, where for three years he pursued mechanical engineering during the evening while working full time during the day. No simple task, this double life often found Bob coming home from work and then plunging headlong into higher mathematics, kinematics, or physics on to the early hours of the morning.

To his shipmates, Bob presents a personality of conscientiousness, joviality, and friendliness. He is often heard in the shower room singing melodies from Carmen, The Bartered Bride, or some recent musical score. The fact that Bob is a musician can escape no one who has come to know him, for his crystal clear tenor voice is often heard singing melodious tunes. More than a hobby to him, music is a method of expressing his inner emotions and fine traits of character, if not by singing, then by playing either the piano or violin. His favorite piece of music is the Second Roumanian Rhapsody, although music of all types holds a warm place in his heart. In a recent musical production presented by the Navy V-12 unit, Bob sang "The Hills of Home" so sweetly that even the most unemotional were touched by its beauty.

Music and engineering—those are the loves of Bob Hayes. Born in Cleveland, Ohio, in 1921, he lived there all his life prior to his enlistment into the Navy in 1942. As a high school student, Bob indicated his preference by attending a technical school. While at school he supplemented study with track, wrestling, music, and student politics. His track earned him two school athletic letters and his scholastic abilities put him in the number one spot of a graduating class of 170 technical students.

In 1943, Bob experienced what he says was his greatest thrill—he entered the Navy V-12 college training program here at the University of Illinois. Taking advantage of all his privileges, Bob sang with the Navy choir, became a member of the Navy Rifle club, participated in the V-12 musical production, ran for the Illinois track team, and, besides, earned a respectable 4.7 average in his upperclassman studies in Mechanical Engineering.

In serious reflection, Bob feels that students in college do not fully appreciate what advantages are before them and do not understand the full significance of this war. He has helped maintain American aircraft going to the front and has seen the men who must fly them. To him this war is filled with sombre reality—to him this war is one of precision material matched against that of the foe, and he realizes that this nation can be free only so long as she has men trained to create a superior war machine. When asked once what he thought was his chief reason for being here, he looked up and in a confident voice replied, "My job here at the University, as that of all students, is to become the best engineer possible in the shortest time so that when the hour of my greatest trial is at hand, my nation can securely depend on me." No one could ask for more—no one can afford to do less.

Recently Bob began assisting Professor Trigger in his research into cutting speeds and feeds and their effect on the cutting tools. The work is new and different—it presents a new problem which each set of data taken. The work is very typical of the type that Bob enjoys—work with a challenge, work that goes beyond that already known and on to the enigmatical. He intends to carry on in engineering research work, but in the field of aeronautics.

Professor Peck Receives Award

By DR. KARL TERZAGHI

Editor's Note: The Norman and Croes Medals, the two highest awards of the American Society of Civil Engineers, were presented to Dr. Ralph B. Peck and Dr. Nathan M. Newmark of the Department of Civil Engineering at the Annual Meeting of the Society in New York on January 17. These awards were made for papers which were judged most worthy of special commendation for their merit as contributions to engineering science. On January 22, the Central Illinois Section of the Society met in Urbana to honor these men. The accompanying address was given by Dr. Karl Terzaghi, the founder of Soil Mechanics, in behalf of Dr. Peck. The address given by Dr. Wilbur M. Wilson, in behalf of Dr. Newmark, will appear in a future issue.

Almost exactly five years ago I was requested to take charge of the soil investigations in connection with the design and construction of the Subway of Chicago. It was obvious that this was a unique opportunity to secure positive information on soft clay, which is one of the most deceptive members of the large family of soils. But it was equally obvious that the success or failure of the mission depended entirely on the mental and moral qualifications of the man who was to carry out my instructions at the site. Since I did not wish to risk a failure and a corresponding unfavorable reaction of the members of the profession to soil mechanics, I considered withdrawing from the assignment unless I should be able to locate a young man who could be expected to satisfy the exacting requirements.

At that time Peck was a graduate student at Harvard University and willing to accept the job. I looked him over, made my estimate and decided to sign my contract with the Subway Administration. The estimate was correct. Otherwise we would not be here to celebrate the fact that he has been awarded one of the highest distinctions which the American Society of Civil Engineers has to offer.

However, we have one more cause to rejoice. We rejoice about the fact that Peck has advanced in a brief period into a position which gives him a unique opportunity for developing his gifts for the benefit of the engineering profession. The credit for it goes to the broadminded and far-sighted policies of the Civil Engineering Department of the University. These policies indicate that the specific function of soil mechanics in engineering education has clearly been recognized.

Soil mechanics was born, several decades ago, out of a sense of bewilderment. The scope of the problems involving soils increased by leaps and bounds while the methods for dealing with them were still medieval. Great deeds have been accomplished in the field of foundation engineering without the assistance of scientific methods and principles, but all these achievements were strictly comparable to the great achievements of the builders of temples, cathedrals and bridges prior to the advent of applied mechanics. They grew out of the intuition and the accumulated experience of exceptionally gifted individuals, but they did not lead to an organic development of the art. Organic development in the field of engineering does not start until the accumulated stock of experience becomes fertilized by science. In structural engineering the transition from the state of art into that of an applied science took place early in the 19th century, when the old rules for construction were still fairly suitable for the solution of most of the contemporary structural problems. But in foundation engineering the transition did not start until the shortcomings of the old procedures became plainly intolerable.

The initial successes in the new field of applied science were so encouraging that a new branch of structural analysis appeared to be in the making. As a consequence, the scope and profundity of the theoretical investigations increased rapidly and the experimental methods were developed to an unheard-of degree of refinement. However, in the heat of the battle one important detail has been overlooked. The anatomy of the majority of natural bodies of soils is so complex that an accurate evaluation of their average physical properties is both impracticable and irrelevant.

Considering the limitations which nature has imposed upon our knowledge of the soil conditions at the site of proposed construction operations and the utter complexity of the physical properties of real soils, the practical usefulness of advanced analytical methods and of refined procedures of testing is very problematical. Under average conditions, material benefits can be derived only from simple and expedient methods for investigating the general properties of the soil and from reasonably reliable rules for extrapolating from the results of observations and measurements on preceding jobs. This statement is based on personal experience. During the last twenty-five years I have acted as a consultant on almost one hundred projects in every branch of applied soil mechanics. Most of these projects involved exceptional difficulties of one sort or another. Yet the instances in which I felt any need to take advantage of the available refinements in investigation were very rare. The only requirements for solving the problems were a thorough knowledge of the physical properties of soils in general and of the fundamental laws of physics; a memory well stock with the details of precedents; a capacity for observation in the field and—last but not least—a good dose of common sense.

But the youngster who emerges from an average course in soil mechanics does not see his future activities in this light. He is fascinated by what can be accomplished under exceptional conditions, thus losing his contact with reality and his sense of proportion. The teacher and research worker in this field is in a similar predicament. This condition has deplorable implications. Irrelevant details are inflated into facts of fundamental importance while really important facts which do not fit the classroom conceptions are brushed aside. Hence, instead of being trained to face his future problems with open eyes the student may leave the university saturated with dogmatic ideas which impair his faculties for unbiased observations and reasoning. Peck escaped this

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ILLINOIS V-12 . . .

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are certain "musts" for a trainee. He must arise each morning at 0600 and exercise until 0630. He must be present at all meals. One hour a week, the trainee must march in formation. There are certain times that he must stand two hour watches. And if the sailor has not kept up his scholastic record, he must remain in his room and study every night from eight to ten-thirty o'clock, at which time all lights have to be out. Bed checks are made frequently. These are some of the restrictions that have been placed on the V-12 trainee to better fit him for his future role as an officer.

Although they have many duties, the men have found time to participate in a host of other activities. The Navy men have entered into the engineering honorary societies. The university's theater guild, band, orchestra, choir, paper, annual yearbook, athletic teams, honorary clubs, and board

Thanksgiving "Chow"

of control have a number of sailors as their active members. The Navy men have even entered the field of campus politics. And today, many of the fraternities would not be active on campus if it were not for their Naval members. Why some of the men have even gone so far as to entrench themselves in the sororities! And so by entering into as many university activities as possible, the Navy is trying to contribute to the university some part of the generosity the school has shown to the men.

The sailors have helped make it possible for the university to continue its program of athletics. Football, basketball, track, and wrestling have all had Navy men in their top rank of performers. The swimming team numbers among its members a large group of Navy men, and at one time, the tennis squad was made up completely of Navy men. By competing in these sports, the Navy men not only contribute their worth to the university, but they also help fit themselves to become better officers.

The physical program that the V-12 takes is a varied conditioning schedule that ranges from the rough and ready tactics of hand-to-hand fighting to baseball and tennis for those that have completed the rougher sports. There are courses that include football, basketball, track, judo, personal defense, boxing, wrestling, swimming, and warfare aquatics. All of these courses include at least four weeks of body-conditioning exercises, for the V-12 must take a strength test every semester and pass with a high grade. If the trainee fails the strength test, he is made to take a complete body conditioning program of sixteen weeks. But the rigors of the strength test, of running three miles, of the obstacle course, or of climbing a twenty foot rope a few times are undergone so often that the tasks are looked upon with every day complacency. At the end of each semester, a physical training report is written to complete the course. This program of physical exercise for V-12, when submitted for supervision, was found so satisfactory that it was put into immediate use all through the Ninth Naval District.

For more recreational athletics, the unit has a tournament in whatever sport is popular at the time. Games such as water polo, wrestling, free throwing, basketball, track, handball, tennis, and baseball have all brought out heated interest and competition among the trainees. Each time a new tournament is announced, each company immediately gets its players together and enters teams with such whimsical names as "Buzzin Duzzin," "3 B's," "Tolerable Socks," "Professors," or any other name that happens to strike the players' fancy. This type of activity is usually held after the evening meal.

At the close of each semester, there is happiness for some and sadness for others. For at the close of each semester, some of the trainees graduate and start out with that feeling of something new to be accomplished. And others stay behind, those who have not completed their training—yes, they remain behind watching their buddies leave and longing for the day when their preparation will be over and they too can go on and join in the fight for which they are training.

Many men who were in the V-12 unit and have received their commission are now coming back to see their buddies. For the University of Illinois, alone, has sent 168 men on their way to midshipmen's school and a commission. And each time one of the new officers stops back, he is overwhelmed with a rush of hand shakes, pats on the back, and millions of questions. But the officer also has many questions to ask. For it has been at least four months since he last was at his Illinois base, and many things have changed for him also. Then the boys start telling him all the news that "floats" around. They tell him how it's rumored that V-12 may all be made into an N.R.O.T.C. unit, how it might be kept even after the war. They tell him about the new girls that have struck their fancy, and how they wish they were he with that gold stripe on his sleeves. Yes, they tell him many things about what they think the future will hold. But for now, the only thing for them to do is wait, wait and train just as they are told to do by the Navy. And when they are ready, the Navy will tell them what their future holds.

HOW TO COLOR A SUNSET

Why is a sunset never green? According to Norman F. Barnes, color specialist, it might be green, or even blue, if it weren't for certain wave characteristics of light.

Barnes, speaking before the Schenectady section, American Institute of Electrical Engineers, at Union College, said that the appearance of a sunset, as well as the blue of the heavens, is due to different wave lengths of light, the effect on them of dust, dirt, water droplets, smoke and other small particles in the air.

Sunlight, he said, is composed of all colors, the primary ones being red, green and blue. Furthermore, light travels in waves, longest of which belong to that light giving the color red, shortest to that giving blue. Green falls some place between the other two. In traveling through the earth's atmosphere, light must pass through a thick veil of foreign bodies, and here the short-waved light, that which gives blue, bounces off the particles in the air.

Carried to an observer, this short-waved light gives a blue appearance to the sky. Farther eastward along the curvature of the earth, the remaining red waves and what is left of the green, some of which may be dissipated on the way, combine to give an orange, or yellow, color to the setting sun. If the earth could be flooded with a deep red light, an orange or yellow sunset would look green in comparison.

First C.E.: Let's cut classes and take in a movie.

Second C.E.: Can't do it, old man; I need the sleep.

* * *

"Can't you do something? My life is hanging by a thread."

"I'll see if I can find a good, strong rope."

* * *

FOUND: Woman's bag left in my parked car. If owner will pay for this advertisement, she can have it. If she will tell my wife how bag happened to be there, I'll pay cost of adv't. Telephone Campus 1800—the quicker the better.

* * *

Once upon a time, so the story goes, the fence broke down between Heaven and Hell. St. Peter appeared at the broken section of the fence and called out to the devil, "Hey Satan, it's your turn to fix it this time."

"Sorry," replied the boss of the lower regions, "my men are too busy to go about fixing a mere fence."

"Well, then," drawled St. Peter, "I'll have to sue you for breaking our agreement."

"Oh, yeah," echoed the devil. "Where are you going to get a lawyer?"

* * *

If it's funny enough to tell, it's been told; if it hasn't been told it's too clean; and if it's dirty enough to interest an Engineer, the editor gets kicked out of school.

* * *

"Well, I'll be damned!" said the babbling brook as the fat woman fell off the bridge into the water.

* * *

"Do you know the difference between a popular girl and an unpopular one?"

"Yes and no."

* * *

Salesgirl: "Would you like something in a two piece bathing suit?"

College Student: "Yeah, Hedy Lamarr."

When is

FIRE
too
COLD?

FIRE was both a tool and a limitation for the ancients. With it they made things of tin and lead, silver and gold. But their fires were never hot enough for the sterner metals.

Man's progress through the ages has been accelerated each time he has learned to create and control a higher temperature.

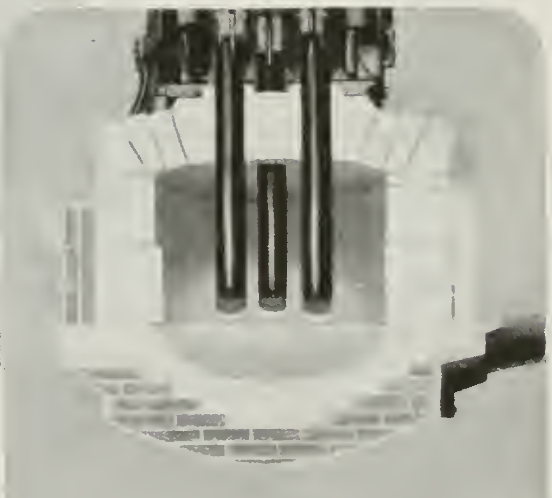
With the electric arc came heat hotter than any fire. And, by means of carbon or graphite electrodes—developed by research of NATIONAL CARBON COMPANY, INC., a Unit of UCC—man put the electric arc to work in furnaces such as the one you see above.

Born in the terrific heat of the electric furnace are many of the alloy steels used in ships, trains, planes and other equipment, and also the ferro-alloys that give strength, toughness, hardness—or the quality of being stainless—to these steels. These materials—and the intense heat that produces them—are vitally necessary to American industrial progress.

▼

Coming from the electric furnace—in addition to alloy steels and ferro-alloys—are phosphorus, abrasives, calcium carbide for acetylene used for welding and cutting, and many special alloys.

For further information write for booklet P-2, "The Story of the Carbon Arc" . . . there is no obligation.



Cross Section of an Electric Furnace

Electricity comes *to* the furnace on metal bars. It is carried *into* the furnace by carbon (or graphite) electrodes, which you see projecting down into a brick lined bowl. Carbon is used because, unlike metal, it will not melt.

You see carbon in many forms other than electrodes. Diamonds are pure carbon. Graphite, which is the "lead" in pencils, is carbon—and so are coke and charcoal. This material is the subject of unending research by the National Carbon Unit of UCC.

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PLASTICS—Bakelite Corporation

ON TO THE FUTURE . . .

(Continued from Page 14)

great power within the atom, which is also as yet denied him.

Another result of the physicist's "atom-smashing" ability is the cyclotron, an instrument which enables the scientist to bombard a substance with deuterons or other particles and obtain a radioactive form or heavy isotope of his original material, or to transform this material into an isotope of a different element. These transformed atoms can be used as "tracers" in order to determine the extent to which there is an interchange of atoms in chemical reactions. By the use of these isotopes, the function of various elements in living tissue has been determined more accurately.

The cyclotron holds infinite possibilities, not only in the field of cytology, but in other sciences as well.

In order that scientific cooperation be made more efficient, it is imperative that young chemists, physicists, and biologists have a thorough background in all sciences. The student who is preparing for a research career should be taught in advanced university courses the operation of the electron microscope, cyclotron, and other apparatus which will soon be commonly used in research laboratories. A more widespread demand for such apparatus may make possible more manufacture, and as a result the cost may be lowered. More universities then would be able to have these now almost rare instruments in their laboratories.

The opportunities for young scientists today are almost endless. We who are high school students now, in a few years will have our chance at shaping the world's future. It is up to us young chemists, physicists and biologists wholeheartedly to join our forces for the future progress of science, so that we can contribute to the well-being of man and help make secure the future of the world.

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For many years, RCA Laboratories have had a constant interest in the technical development of FM. Research in this field continues, but most of it is related to the war effort and is of a military nature . . . Prior to the war RCA manufactured and sold FM broadcast transmitters. After the war RCA will manufacture and sell a complete line of FM transmitters as well as high-quality super-FM receivers, utilizing a new type of circuit.

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PROFESSOR PECK . . .

(Continued from Page 20)

fate. He stepped directly from the classroom into a difficult tunnel under construction and there he went through a post-graduate course of exception merit, the tough school of experience—that sort of experience which is acquired not by shoving sample after sample into a testing machine and operating the slide rule, but by observing day by day the reactions of clay in the field on the encroachments of the construction engineer.

Once Peck had enrolled in the school of experience, I watched him jealously and persistently, lest he may escape from the hole in Chicago before he has reached a state of maturity. Owing to the fact that he stuck it out, he entered your institution as a man whose professional personality was shaped and molded by first hand and not by second hand impressions. And it was one of the great joys and satisfactions of my life to see that the heads of his department have rapidly grasped the essence of his mission and are ready to provide him with the facilities required for accomplishing it.

His mission is to collect and to digest data pertaining to full-sized structures and to use them as building stones in the walls and buttresses of our semi-empirical procedures. The contents of the paper which has received the award is a typical example for what he has to achieve, on a broader basis, in the future. The fact that Peck's paper has received a high award by the leading Engineering Society of the country indicate clearly enough that I am not the only one who recognizes the intrinsic value of this type of contribution to our knowledge.

To accomplish his task, Peck must maintain his contacts with those who are to be the beneficiaries of his endeavors, the construction engineers. The contacts are established and maintained by the various cooperative agreements between the Engineering Department of your University and those among the Foundation Committees which specialize in collecting and assembling data regarding full sized structures. If these agreements are carried out for a decade or so, the Department and its instrument, Professor Peck, will receive and deserve the gratitude of the profession.

But knowing the subject well and broadening our knowledge is only one of Peck's duties. The other, equally important but more difficult one is to teach it successfully. I have taught the subject for many years but the results have been very disappointing. Examining the reasons in retrospect, they are quite plain. All my youthful aberrations have been enthusiastically perpetuated because they responded to the irrational craving of the human mind for certainties even in fields which are entirely governed by the laws of probability. Students take to gadgets and neat little mathematical procedures like ducklings to water. But the essence of my teachings, dealing with the art of reducing the hazards of design and construction to a minimum in spite of the inevitable uncertainties involved—this essence which constitutes the last core of soil mechanics has been persistently slighted or even ignored. However, Peck has the great advantage that he takes over the heritage in a radically disinfected condition. Therefore, I express the hope that he may succeed where I have failed and that he may educate a generation of foundation engineers who retain their common sense and their sense of proportion in spite of having been fed a dangerous drug; the drug of higher learning. Now and then this drug produces marvelous mental growth, but far oftener it has the opposite effect.

Definition of a bachelor: A man with no children to speak of.


CLEANING STEEL with BRUSHES of FLAME

TECHNOCRACKS . . .

One Coed: "Why don't you wear that lovely lingerie you got for Christmas?"
Second Same: "I'm saving that for a windy day."

* * * *

The Technograph is a great invention,
The school gets all the fame,
The printer gets all the money,
And the staff gets all the blame!

* * * *

The little old grey woman bent over the cherub in the cradle.
"O-o-o. You look sweet, I could eat you."
Baby: "The hell you could, you haven't any teeth."

* * * *

First pre-med: "Going to the appendicitis lecture?"
Second pre-med: "No, I'm tired of organ recitals."

* * * *

Mrs. Henpeck (at a movie): "Is your seat comfortable?"
Mr. Henpeck: "Yes, my love."
"Have you a good view of the screen?"
"Perfect, dear."
"Are you bothered by the conversation of the people on the other side of me?"
"No, darling."
"Then change seats with me."

* * * *

The mad engineer's latest research deals with a speedometer that will play "Nearer My God to Thee" when the pointer hits the 90 mile an hour mark.

* * * *

"Why, this water runs off my back like water off a duck's back," said the duck.

* * * *

The fortunate youth gazed delightfully at his stunning date as she gracefully descended the stairway. His heart beat violently as he realized that all this beauty was his. Charmingly she stood before him and whispered, "How do I look?"
"Sweetheart," he murmured as he took her in his arms, "you look mighty good to me."
"Don't let your impressions mislead you," she breathed, snuggling closer.

"It's nice to kiss in a shady parking place, but the boyfriend doesn't stop there."
"You mean—."
"Yes, he keeps right on driving."

* * * *

E.E. (they're always sparking): "We certainly had a big time last night on one dime."
Coed: "I'll say. I wonder how little brother spent it?"

* * * *

Little Johnnie had torn his trousers twice in the course of one morning, and when he came in with his pants torn again his mother said: "You go right upstairs, remove your pants, and mend them yourself."
Some time later, she thought of him and went upstairs to see how he was getting on. The torn pants were lying on a chair, but there was no sign of Johnnie. Returning downstairs, she heard a noise in the cellar and decided that he was down there playing. "Are you down there running around without your trousers on?" she called loudly.
"No, madam, I'm just reading the gas meter," a deep voice answered.

* * * *

Employer: "Say, how long did you work on your last job?"
Applicant: "Three months."
Employer: "Only three months? What did you do?"
Applicant: "Ninety days."

* * * *

Chemistry Prof. (on a chemistry quiz): "Give the physical properties of H_2S."
Student: "Well, confidentially, —!"

* * * *

Frosh: "Ginger Ale."
Waiter: "Pale?"
Frosh: "No, just a bottle."

* * * *

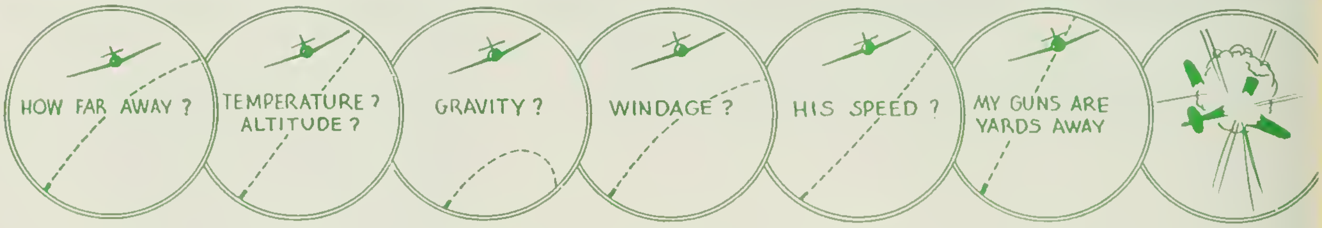
THESE MODERN CHILDREN!
Just the other day we passed a group of school children playing drop the Kleenex.

* * * *

He: "I can't see what keeps the girls from freezing."
She: "You're not supposed to."

Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD



HEAVY HEADWORK

THE Boeing B-29 Superfortress has an "electric brain." And it's pretty comforting and assuring for a gunner to toss some of the heavy headwork over to it when a Jap Zero is pumping shells at him and flying as fast as he is, or faster.

The "brain," or computer, is continuously solving an equation and making a continuous adjustment of his gun's aim. There are many elements in that equation—temperature, plane speed, windage, for example. And his bullet is fired, not at the enemy plane, but at where it's going to be a fraction of a second later. The computer supplements and corrects human judgment in the factors conditioning that aim, takes over that part of the gunner's responsibility.

The "brain" has electronic tubes—plus other electrical and mechanical elements—to help with its important thinking. The corrections are relayed to the guns continuously and automatically. And the gunner is free to concentrate on the business of keeping the Jap plane framed in his sights.

BOUNCING PUTTY

BOUNCE it like a ball—pull it like taffy. "Bouncing putty" is the most entertaining member of the silicone family. It's a by-product of the research that's kept G-E chemists busy for a number of years.

As a result of their work, silicon, an element found in sand and glass, has become the backbone of a whole new group of compounds. One of them is a rubber that stands temperatures from 575 F all the way down to 60 below. Groups of atoms—silicon and oxygen—arranged in a repetitive manner, make up its polymeric molecules.

Silicone rubber can be used for a lot of things, such as gaskets in turbosuperchargers and searchlights. It's unique, because it returns to its original height and shape even after compression under extreme heat.

MOIDER DA BUMS

DOWN in New Guinea tonight they're burnin 'em over the plate . . . and heaving coke bottl at the umpire.

Antiaircraft battalions made night baseball possibl first by bulldozing a piece of jungle clear and leve Then the boys made 12 coconut trees into pole installed them around the field, and nailed 20-foo square white board reflectors to the tops of them. Th anchored 800-million candlepower searchlights the base of each pole, and focused their beams on tl white boards.

General Electric salutes its fellow lighting engineer who found a way to bring Brooklyn to the Ne Guinea jungle. *General Electric Co., Schenectady 5, N.*

Hear the G-E radio programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, Monday through Friday, 6:45 p.m. EWT, CBS—The G-E House Party, Monday through Friday, 4:00 p.m. EWT, CBS.

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Illinois Technograph

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

May, 1945

20 Cents

Illinois Technograph

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Arkansas Engineer, Colorado Engineer, Cornell Engineer, Drexel Technical Journal, Illinois Technograph, Iowa Engineer, Iowa Transit, Kansas Engineer, Kansas State Engineer, Marquette Engineer, Michigan Technic, Minnesota Techno-Log, Missouri Shamrock, Nebraska Blue Print, New York University Quadrangle, North Dakota Engineer, North Dakota State Engineer, Ohio State Engineer, Oklahoma State Engineer, Oregon State Technical Record, Pennsylvania Triangle, Purdue Engineer, Rose Technic, Tech Engineering News, Villanova Engineer, Wayne Engineer, Wisconsin Engineer, and Cooperative Engineer.

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The Tech Presents

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COVER—Shown on the cover is a trainload of M-18 tank destroyers leaving the Buick factories. Developed and manufactured by Buick in cooperation with the Army Ordinance and Tank Destroyer Command, the weapon was used most effectively in the European Theatre.

☆ ☆ ☆ ☆ ☆ ☆

The Experimental Basis for the Steam Table Values

By ERNEST K. FRAZIER, JR., M.E. '45, V-12

Abstracted from bulletins published by the National Bureau of Standards on research work done by that organization on the thermal properties of saturated water and steam.

A program of steam research sponsored by the American Society of Mechanical Engineers, has been going on in this and other countries, for a number of years. Its purpose has been to extend and improve existing steam table for use in the engineering field. In addition to fulfilling its purpose for steam-power engineering, the new data has been of wide interest and is of value to other fields of science, such as chemical thermodynamics. As its share, the National Bureau of Standards undertook to determine the thermal properties of saturated water and steam. The first portion of this project increased the region up to 270°C and 56 kg/cm^2 and was completed and published in 1930. The second portion, overlapping the first, increased the region up to 374°C and 225 kg/cm^2.

One by-product of the calorimetric investigation is the new determination of saturation pressures and the compilation of tables of this property. This knowledge enables a correlation of data and a uniformity of the table resulting from this data.

The method involved will be explained as follows: A sample of water was isolated in the calorimeter, its amount, state and energy being accounted for. The sample was allowed to pass through a chosen and accurately determined change of state and the change in properties and energies were measured. The change of state was affected by the addition of heat by an electric heater enabled accurate determinations of the heat added.

In addition to the electric heater and the calorimeter shell, valves were provided, for taking out water or vapor. Detachable receivers were used to measure the quantity of water removed. The calorimeter was well insulated against radiation and conduction of heat, to insure proper isolation of the system. Pressures were measured by a system of weights on a floating piston which transferred the pressure to the calorimeter body by capillary tubes. The temperature was measured by the variation of the resistance of a platinum wire inserted in the calorimeter. The important measurements, however, were of the mass of fluid contents before and after the experiment and the energy of the system. The group of measurements yielded the enthalpy and several other important properties of the water and vapor and established the thermal behavior of the fluid in the region covered by the survey.

The apparatus was designed to permit four special types of experiments to be made. They were as follows:

A) Heating with fixed amount of contents.

B) Isothermal expansion by adding heat, evaporating liquid, throttling, reheating, and removing superheated vapor at the saturation temperature and reduced pressure.

C) Isothermal expansion by adding heat, evaporating liquid, and removing saturated vapor.

D) Isothermal expansion by adding heat, evaporating liquid, and removing saturated liquid.

A single equation may be written which will express the equilibrium of energies of the isolated system. It is called the general equation.

NOTATION

ΔUa—Internal energy of calorimeter
ΔUx—Internal energy of contents
ug—Internal energy of unit mass of saturated vapor
uf—Internal energy of unit mass of saturated liquid
u—Internal energy per unit mass of fluid transferred
vg—Specific volume of saturated vapor
vf—Specific volume of saturated liquid
dM—Infinitesimal element of mass of fluid transferred
W—External work done by the system in any experiment
P—Absolute pressure

$$I_o[Q]_1^2 = [\Delta U_a]_1^2 + [\Delta U_x]_1^2 - \int_1^2 u\, dM + W$$

II The total volume V=MaVg+M(1-a)Vf
a=vapor fraction.

III The total internal energy ΔUx=MaUg+M(1-a)Uf
From II and III we get:

$$\Delta U_x = [u_g - u_f] \frac{V - Mv_f}{V_g - V_f} + M u_f$$

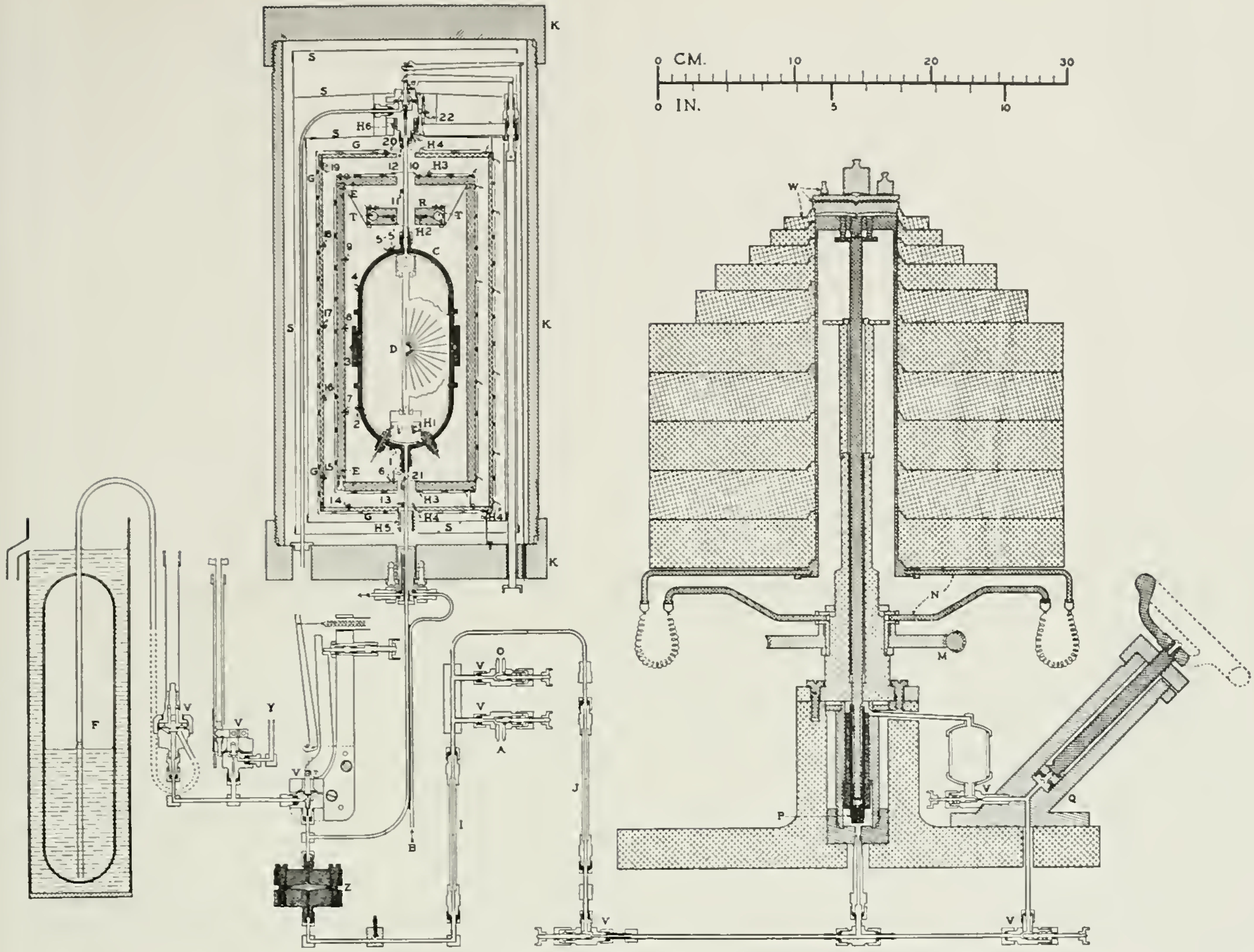
$$\Delta U_x = (V - Mv_f)\left[\frac{u_g - u_f}{V_g - V_f}\right] + M u_f$$

V The following thermodynamics relations may be used:

hfg=hg—hf   hf=uf+Pvf
hg=ug+Pvg
hfg=Ug—Uf+P(Vg—Vf)

Substitution of these in IV yields:

$$\Delta U_x = (V - Mv_f)\left[\frac{h_{fg} - p\,(V_g - V_f)}{V_g - V_f}\right] + M(h_f - pv_f)$$



SECTIONAL DRAWING OF VAPOR PRESSURE MEASURING EQUIPMENT

From which we get:

$$\Delta U_x = V\left[\frac{h_{fg}}{V_g - V_f} - p\right] + M\left[h_f - \frac{V_f}{V_g - V_f} h_{fg}\right]$$

A similar equivalent for $[W]^2$, may be found. This consists of two possible parts, one the work done against the external pressure by reason of an increase in volume of calorimeter shell, and the other the work done by the fluid as it issues from the calorimeter.

$$W = -\int_1^2 pv\,dM$$

VIII Substituting these values of W and ΔU_x in the original equation (equation I) we get:

$$[Q]_1^2 = \left[\Delta U_a - Vp + \frac{V}{V_f - V_g} h_{fg}\right]_1^2 + \left[M\left(h_f - \frac{V_f}{V_g - V_f} h_{fg}\right)\right]_1^2 - \int_1^2 h\,dM$$

which is the refined general equation.

The first term involves the internal volume and internal energy of the container itself but is independent of the amount of fluid contents, excepting that enough fluid must always be present to maintain the saturation condition.

The second term expresses the heat added by virtue of the combined change in amount and state of the portion of fluid within the calorimeter between the beginning and the end of the experiment.

The third term completes the account by expressing the heat taken away from the system by the portion of fluid withdrawn.

By the application of this equation to the four different types of experiments the enthalpys could by determined by knowing the mass of the fluid in the calorimeter and the amount of electrical energy put into the calorimeter.

A correction had to be made to account for the amount of heat necessary to vaporize enough liquid to fill the space vacated hy the fluid withdrawn.

A Scotchman walked up to a friend at the bar and began telling him about a hunting trip. "We shot a couple of deer," he said. "But the biggest thrill was tracking yures."
"What's yures?" asked the friend.
"I'll have a beer, thanks," replied the Scotchman.

History of the . . .

College of Engineering

By DEVORA SCHIFF '48

The Illinois Technograph, the technical magazine published by the students of the College of Engineering, was started in 1886-87 by the Civil Engineers' Club, which issued the first four volumes of the Magazine under the title "Selected Papers of the Civil Engineers' Club." In the fall of 1890, the Club combined efforts with the Mechanical Engineer Society to publish volume five of the periodical, which by that time was called "The Technograph."

The predominating features of the Selected Papers and the early issues of The Technograph were technical discussions of an exceedingly high quality. Many of the articles are being republished in current engineering literature. Volume one contained an article by W. D. Pence '87, on "Hutton's Formula for Normal Wind Pressures." This paper described the classic experiments of Hutton from which much of the information about wind pressure was derived. Professor Baker's article "Hints to Students on the Education of an Engineer" was republished many times.

In the second volume was an article by Professor Talbot on "Waterways for Bridges and Culverts," which became a part of the standard engineering literature. The third volume contained two articles by Professor Baker which were subsequently included in his book "Masonry Construction." Volume four contained an article by J. B. Tscharner, CE. '90, on the adhesion of drift bolts, which was said to contain more information on the subject than all other records.

The Architects' Club, after it was formed in 1891 and the Mechanical Engineering Club, joined with the Civil Engineering Club during 1891-94 to publish volumes six to nine inclusive. Volume nine stated that the editorial board consisted of nine members, three of whom were selected from each of the three engineering societies.

The 1895-96 issue contained the following statement in regard to editorial policies of the publication: "The Technograph is a scientific publication published annually by the Association of Engineering Societies of the College of Engineering of the University of Illinois. It is essentially technical in scope and contains articles of permanent value in the various departments of scientific investigation carried on at the University or by its graduates."

For about ten years following this issue, the Technograph continued publication with but few changes in its make-up of from 40 to 160 pages. It included some material of local interest about the affairs of the University, but the greater portion was comprised of technical articles of real value to practicing engineers and students alike. Volume 20, issued in 1905-06, contained an index of all the articles that had been published in the magazine up to that date.

The policies of "Tech" in the early 1900's were expressed in the foreword to the 1907-08 issue as follows: In publishing the Technograph, the attempt has always been made to rise somewhat above the general college periodical, into a sphere which may contain something of interest to the graduate and the practicing engineer.

The magazine has an intermittent career, however, during the years 1910-1919, the first reverse in its history. The expense of publication was nominally borne by the advertisements and by sales, and of course the returns from these sources depended upon the activities of the students in charge. If there were no money with which to pay bills, an appeal had to be made to the cooperating societies. Because of the indifference in response to those appeals and because of the discouragement over the financial conditions resulting from the 1909-1910 issue, the paper was threatened with financial ruin and suspension.

One thing that had, no doubt, been partly responsible for the indifference was that there had been a feeling among the students and the faculty that the Tech in the preceding few years as an annual did not measure up to its possibilities. It was generally felt that some change was needed to make the organ of greater appeal. After some deliberation in which Dean Gross and faculty and student representatives took part, the Association was remodelled in 1910-1911.

The name of the organization sponsoring the magazine was changed from A of E S of U of I (Association of Engineering Society of the University of Illinois) to Engineering Societies of the University of Illinois. Under the new order, two representatives from each group forming the engineering societies constituted the Technograph Board, one sophomore being elected at the end of each year, who remained in office for two years. This arrangement assured continuity in office and a means for carrying out definite policies of management. The editor, business manager, and other officers of the staff were chosen from the Board. There was appointed an Advisory Board consisting of the Dean of the College of Engineering, two faculty members, and two alumni representatives. The magazine was made quarterly. The price of a single issue 25c and subscription $1 per year.

In 1916-1917 only one quarterly number was issued, containing only 58 pages. In 1917-1918 notwithstanding the disturbance of World War I, four numbers were published. The war did, however, bring its problems, and the magazine had to suspend publication completely due to lack of men and the high cost of materials. No issues were published in 1918-1919 nor in 1919-1920. The paper resumed publication, however, in the fall of 1920, but the magazine was completely reorganized. The size of the page was changed from pocket size to letter-head size. The custom was established of having a different cut on each front cover. In March, 1923, the periodical became affiliated with the Engineering College Magazine Association, an organization sponsored to raise the standards of its member magazines by adoption of uniform standards of practice and by cooperation in both business and editorial problems. It was continued as a quarterly and the price was 40c a copy. Subscriptions to the Technograph were included in membership dues to the various professional engineering societies. The usual yearly volume contained about 200 pages, although the 1928-29 volume contained 250 pages.

In 1930-31, the magazine became a monthly publication appearing with seven issues: October, November, December, February, March, April, and May. During 1931-32, there were eight issues. During that year, also, student articles were featured and new space was given to honorary and professional organizations on the engineering campus. In 1933-34, the editorial policy was changed to reduce the number of technical articles and to describe more fully the activities of the students and to begin a Who's Who among the student leaders of the college. During that year, the "Tech" became a quarterly again and continued as such until the end of 1936-37. During 1937-38 and 38-39, there were six issues, a page of each being devoted to a Who's

(Continued on Page 18)

Engineering Honorary Organizations

By ROBERT BOHL, Met.E. '45

An engineer is proud of his profession, and proud of his knowledge, for upon his ability and judgment rest not only incalculable intrinsic values and the priceless value of human life, but also the progress of life and civilization. When in school, his first objective is to prepare himself for the day when he will assume a role in his profession and carry on the high standards set by engineers who have proceeded him.

When it is felt that a man has succeeded well in preparing himself adequately while in college, it is only right that his efforts should be rewarded and that is the purpose of engineering honoraries—to honor the man and his achievements.

Because of the decreased enrollment in the engineering college, some of the societies for specialized fields have become inactive, but some of the other fraternities are carrying on with decreased membership.

The two all-engineering honoraries to which students in all fields of engineering are eligible are Tau Beta Pi and Sigma Tau.

TAU BETA PI

Tau Beta Pi was founded in 1885 at Lehigh University, in an effort to secure an honorary reward for high scholarship which would be open to every student in every department of the University. This object could not be accomplished through Phi Beta Kappa, and Dr. E. H. Williams of the Lehigh engineering faculty, after long and careful preparation, began the history of Tau Beta Pi by initiating the first member in 1885. The idea of the fraternity was popular, and its growth paralleled that of its "rival" fraternity, Phi Beta Kappa, until at present, there are seventy-six active chapters of Tau Beta Pi throughout the country.

Candidates for membership are elected by the undergraduate chapter by a secret ballot and by a majority vote. To be eligible for election, a junior must rank in the upper eighth of his class, and a senior in the upper fifth of his class. In addition to the scholastic attainments of a candidate, the personal characteristics of the man are taken into careful consideration in deciding his eligibility for membership. Tau Beta Pi has a high standard of membership and this high standard is carefully preserved in selecting new members.

SIGMA TAU

Sigma Tau fraternity was founded in 1904 at the University of Nebraska when a group of upperclassmen of the engineering college held a banquet and announced the organization of a new honor society in engineering. Within a few years, the fraternity reached nation-wide scope. At present there are twenty-five active chapters. The Theta Chapter at the University of Illinois was established in 1904.

The election of undergraduate members is by a unanimous vote of the active members of the chapter. Junior and senior engineers are eligible for membership. To be considered, a junior must have a 4.5 average, and a senior must have an average of 4.0. The quality of membership is kept high by selecting candidates from these men on the further basis of practicality and sociability.

In addition to these fraternities which recognize merit in all fields of engineering, most of the individual schools in the engineering college have societies which limit their honors to men in their particular line of study.

KERAMOS

The fraternity of this description in the ceramics college is Keramos, which was organized on this campus in 1915, and continued as a local organization until 1925, when a chapter was established at Ohio State university. In 1932, Keramos merged with a similar honorary, Beta Pi Kappa. At the present time there are seven chapters in the country, some of which are in enforced inactivity due to the decreased enrollment. The objects of the fraternity are to emphasize scholarship, character and stimulate interest in ceramic engineering. Members are chosen on a basis of scholarship interest, ability, and personal qualifications for success in the field of ceramics.

CHI EPSILON

The honorary society in the civil engineering college, Chi Epsilon, was also founded on our campus. In 1922, two groups independently took steps to establish a civil engineering honorary fraternity, and, when the two became known to each other, plans were made to merge the two, and form Chi Epsilon. Growth of Chi Epsilon was rapid, and the present chapter rolls list nineteen universities from coast to coast.

To be eligible for membership, a student must be a junior or senior enrolled in civil or an associated engineering course, and have a scholastic average above 4.0. Election is then held on those eligible by the active members of the chapter upon consideration of the basic requisites for a successful engineer—scholarship, character, and sociability. A three-fourths vote is necessary to elect a candidate to membership.

ETA KAPPA NU

In the field of electrical engineering, the honorary society is Eta Kappa Nu, founded to stimulate and reward high scholarship among electrical engineers. The organization had its beginning at the University of Illinois in 1904, and now has chapters in most leading engineering schools over the country with thirty-eight active chapters, and eleven alumni chapters located in prominent industrial centers. As with most of the national honoraries, Eta Kappa Nu publishes a magazine of professional and personal interest to its members—"*The Bridge.*" One of the many ways the fraternity acts to advance its profession is by making its annual outstanding engineer award. A group of prominent engineers select a professional engineer to receive the award. To be eligible the man must be less than thirty-five

(Continued on Page 30)

Metal Cutting Temperatures

By ROBERT HAYES, M.E. '45, V-12

Editor's Note: This article by Robert Hayes was taken from an undergraduate thesis written by him, in which he reported the results of a series of tests upon metal cutting temperatures. These tests were carried on in the Machine Shop Laboratory with the cooperation of Professor K. J. Trigger.

Effect of Feed on Cutting Temperature

Figures 1 to 5 are the graphic representations of results obtained from the tests in which the feed was varied with speed and depth held constant. As can be noted, the cutting temperature in degrees F. was plotted as the ordinate, and feed, in ipr, on a logarithmic scale as the abscissa. The temperature trends are those determined at the indicated

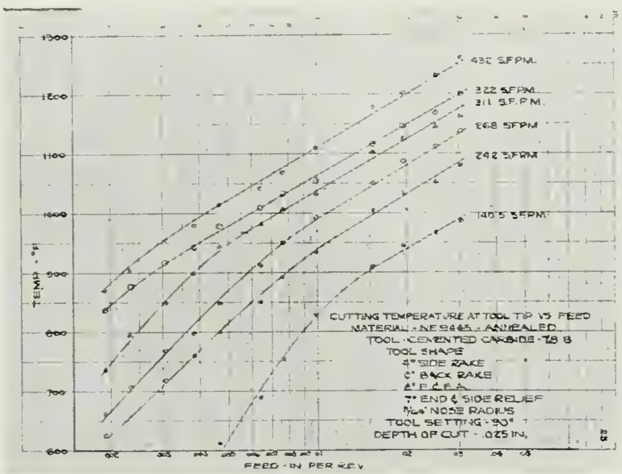


FIGURE 1

cutting speeds, and the four curve sheets represent the results of tests conducted at depths of cut of 0.025, 0.050, 0.075, and 0.100 inch, respectively.

The same general temperature trends were observed for the depths of cut at which tests were run, *i.e.*, at a given speed and depth of cut, the cutting temperature increased as the feed increased. It was found that a considerable portion of each temperature trend plotted as a straight line on the selected coordinates, and that at the same depth of

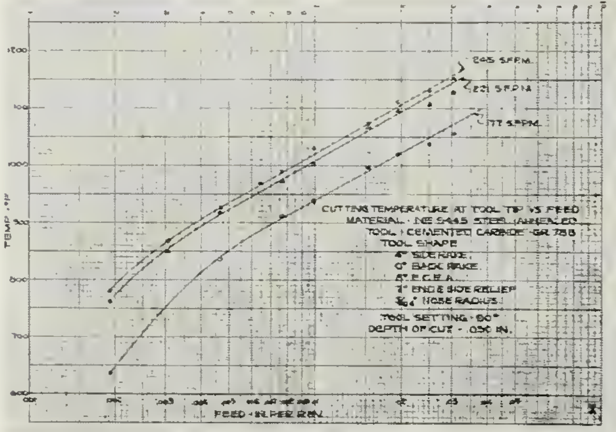


FIGURE 2

cut the straight line portions lay essentially parallel. On comparison it was further found that the straight line portions of the curves for 0.025 and 0.050 such depths of cut were parallel. Similar parallelism existed for depths of cut of 0.075 and 0.100 inch though the slopes of the lines at 0.025 and 0.100 inch were somewhat different.

In all tests, it was observed that at the finer feeds, some unstable cutting conditions existed and the cutting temperature curves at these fine feeds were of constantly changing slope. At the finest feed, the slope was greatest and steadily decreased as the feed increased until a line of constant slope was reached. For a given depth of cut an increase in the cutting speed decreases the feed rate necessary to give a constant slope. That is, stable cutting conditions obtain at a lower feed as the speed is increased. It would seem plausible to assume that at a high enough cutting speed, a straight line trend, indicative of a stable cutting condition, would exist over the entire range of test feeds. The nearest approach to this condition is shown for 344 sfpm and 0.10″ depth of cut, figure 4.

In an effort to determine the possible cause or causes of the unstable cutting condition at the finer feeds, several tests at a depth of cut of 0.100 inch were carefully studied, four of which are those plotted in figure 4. At each test run the condition of the tool was carefully checked, and samples of the chips were examined. On the basis of the studies it is believed that the unstable cutting condition as evidenced by the curved portion of the temperature curves was due

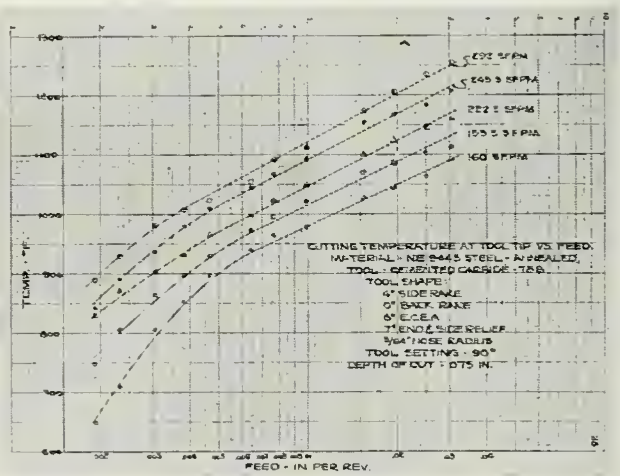


FIGURE 3

to the formation of an excessive built up edge at the tool tip. Such a built up edge alternately formed and wiped off on the chip producing a rough non-uniform chip surface. As the feed, at a given speed, was increased the magnitude of the observed built up edge decreased and ultimately disappeared from the tip of the tool.

The degree of roughness of the chip surface decreased with an increase in feed, so that the surface of the fifth chip, taken at a feed of 0.0047 ipr, is virtually clear, as are the remaining chips of the test. An examination of the surface of the first four, though more specifically the first two, chips will show that the roughness is somewhat regular in its appearance, and the layer formation at intervals could be due to the alternate building up, and wiping off on the chip, of a false edge at the tip of the tool. It is to be noted that the four chips bearing a rough surface correspond to the four points displaced from the straight line portion of the temperature trend, and that the decrease in chip roughness can be correlated with the decrease in slope. A further correlation obtains between the size of the built up edge at the tool tip and the roughness of the chip. It was noted that at finest feed, a pronounced built up edge was present, the size of which decreased as the feed was increased. When the feed was such that a smooth chip was obtained (and the slope of the cutting temperature curve became constant) only a very slight built up edge was evidenced at the tip of the tool.

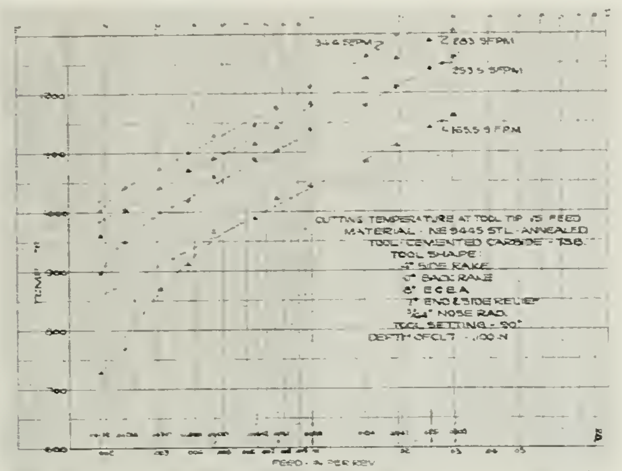


FIGURE 4

Effect of Cutting Speed on Cutting Temperature

In figure 2 are shown the results of five tests in which the cutting speed was varied while the feed and depth of cut were maintained constant. The cutting temperature, on a logarithmic scale, was plotted as the ordinate, and cutting speed, also on a logarithmic scale, was plotted as the abscissa. Throughout the tests, the feed was constant at 0.01 ipr and the depths of cut were 0.025, 0.050, and 0.075 inch.

As would be expected, the general temperature trend was one of increasing temperature with an increase in speed. Over the entire speed range, a higher temperature obtained when the depth of cut was increased. On the selected coordinates, the trends plotted for the most part as straight lines which were essentially parallel, with the exception of the test corresponding to a depth of cut of 0.025 inch. As in the variable feed tests, it was observed that a condition of changing slope existed at the lower speeds for three out of the five tests. As previously explained, this is believed due to the formation of an excessive built-up edge at the tool tip, which could cause an unstable cutting condition.

The two temperature trends at 0.050 inch, and those at 0.075 inch depth represent original and check tests designated by suffix figures 1 and 2, respectively at each of the depths. At 0.075 inch depth the check test conducted under the same conditions as the original, corroborated very closely the first test, lying only very slightly above it. At the 0.050 inch cut depth, however, the second, or check test, indicated a temperature trend somewhat higher than that recorded in the original test. It is believed that the discrepancy between the tests may be explained by the fact that the tests were not conducted under precisely the same conditions. The first test was conducted at a work-piece diameter of 3.065 inches, and subsequent to a high speed test at 0.100 inch depth of cut, from which a slight cratering of the top surface of the tool behind the cutting edge resulted. The second test was conducted at a work piece diameter of 2.615 inches, and with a newly ground and honed tool. Since no specific tests were conducted for the purpose, the exact effect of varied work piece diameter on the cutting temperature, other conditions being constant, is not known; however, it is suspected that a decrease in diameter would not cause an appreciable change in cutting temperature, since the tool was set at center, and the angle through which the chip was deformed would remain essentially the same. The cratered tool in the first test, as compared with the newly ground tool of the second, is believed to be the cause of the lower temperature trend, in that the crater would, in effect, increase the back and side rake of the tool, such effects being known to reduce the cutting temperature.[2]

The temperature trend for a depth of cut of .025 inch did not lie parallel to the curves for greater depth of cut. This was believed due to the cut being made entirely on the nose radius rather than the side of the tool, since the nose radius was some 0.017 inches greater than the depth. This, in effect, changed the setting angle of the cutting edge relative to the work piece from the 90° maintained throughout the tests. This may be the reason for the change of slope of the temperature curve.

Shown on the graph, figure 5, are the equations of the straight line portions of the temperature trends. They are of the general form

$$T = CV^n,$$

in which T is cutting temperature (F), V, cutting speed (EFPM), C, a constant, and n, an exponent depending upon the slope of the curve. The exponential equations are satisfactory for calculating cutting temperatures at selected speeds over the straight line portion of the speed range

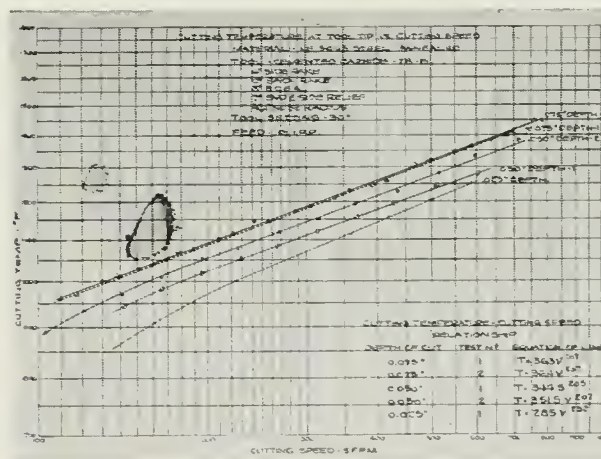


FIGURE 5

given on the appropriate graphs. In all probability they may be applied to speeds above the range since there is no evidence to indicate that the straight line portion of the curve would be altered.

Extrapolation to speeds below the straight line portion of the range will, however, lead to erroneous temperature values. For example, at a depth of cut of 0.075″ and a cutting speed of 1 sfpm the cutting temperature is calculated as 363 F. This value is undoubtedly too high. The changing slope of the trends at the lower speeds would probably bring the cutting temperature to a reasonable range, lower than that indicated by the equations.

General Discussion

The thermocouple principle as applied in the Herbert-Gottwein couple really measures the average emf of the several couples produced by the chip bearing on the tool surface. In the case of unstable cutting conditions it is believed that a built up edge would, in effect, produce a

(Continued on Page 18)

Biographical Sketches of . . .

FAMOUS ENGINEERS

Editor's Note: These sketches were written as part of the semester's work by the students in "Technical Report Writing." The authors are all senior civil engineering students.

THOMAS ALVA EDISON

By William Chalker

On February 11, 1847, there was born in Milan, Ohio, a boy who was to become one of the great benefactors of mankind, Thomas Alva Edison. In later life he brought us many of the conveniences which we now consider practically indispensable. As I sit working in the light of an incandescent light I am reminded that it was he who contributed this means of enabling civilization to continue its pursuits long after the light of the sun has disappeared. This product of the labors of this great man serves adequately to perpetuate the command of our Lord, "Let there be light."

Edison's father was a well-to-do farmer and merchant, and his mother was a woman of culture and education. During the early years of his life, as a frail, seemingly subnormal child, he showed little of the promise of later life. Because of his ill health, he was at first not allowed to attend school; his mother ably assumed the responsibility of tutoring him. To many he seemed "queer" because of his endless questions about things around him, but it was this quality of sincere curiosity that later enabled him to create so many useful implements.

As early as ten years of age, he had his own small laboratory where he repeated simple experiments from the elementary physics and chemistry texts of that day. Through the influence of his mother he had read many of the classics and had even attempted to read and understand Newton's "Principia."

At the age of twelve, he persuaded his mother to allow him to begin work as a newsboy on the Grand Trunk Railroad between Detroit and Port Huron. In only a short time he, with the hired help of two other boys, had two small stores in Port Huron, selling periodicals, vegetables, and fruit. At the outbreak of the Civil War he took advantage of the increased demand for news and set up a small press in a baggage car, where he edited and printed his own newspaper. With the rapid advance of telegraphy young Tom became very interested in it and began to construct small sets of his own. One morning Edison saved the young son of the station operator at Mount Clemens from being run over on the tracks, for which act the child's father showed his gratitude by teaching Tom the art of railroad telegraphy. In only a few short months Edison mastered the art and was accepted for the position of night operator at Stratford Junction, Canada. Later he accepted a job with the Western Union Telegraph Company at Boston.

It was at Boston that Edison began his career as an inventor by constructing and patenting an efficient vote recorder. Here, also, he invented the stock ticker and the quadruplex telegraph. He sold the rights to his stock ticker to the Gold and Stock Company of Boston for $40,000. With this seemingly prodigious sum of money he rented a shop in Newark and began producing stock tickers. Here, he improved an automatic telegraph invented by George Little; made the first typewriter from a crude wooden model brought him by Sholes, and made the telephone practical by producing the carbon-box transmitter, for which he received $100,000 from the Western Union Telegraph Company.

Through the use of his rapidly increasing capital, Edison established a laboratory at Menlo Park, New Jersey, where, in 1877, he began work on the incandescent lamp, for which he is best known. After literally thousands of trials he finally hit upon a workable model which consisted of a crude carbonized thread inserted into a glass-enclosed vacuum. Credit and praise are given by all to Edison for his incandescent lamp, but few are conscious that the greater part of the laudation should be extended him for his development of dynamoelectric generators, switches, meters, and distribution systems which made the incandescent lamp more than just an interesting experiment. His Pearl Street power station was the grandfather of our present complex electric power network. Edison is credited with the major part of the development of the electric locomotive, the invention of the phonograph, the motion picture camera, and one of the first practical electric storage batteries. Among Edison's last developments were a highly improved brick kiln and numerous nautical sound-detecting devices which he developed during World War I while a member of the Naval Consulting Board.

The qualities of character which enabled Edison to live such a productive life were intense curiosity, stubborn perseverence, and the capacity for long and hard work. During a great part of his life he is known to have worked on an average of twenty hours per day. His general philosophy of life can be summarized in his own statement, "Genius is one per cent inspiration and ninety-nine per cent perspiration." It was the state of mind exemplified by this quotation that led him onward to become one of America's greatest men and certainly its greatest inventor.

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JOHN BRASHER

By R. F. Reinhard

John A. Brashear was born November 24, 1840, in Brownsville, Pa., the first of seven children born to Basil Brown Brasher and Julia Smith Brasher. There were five boys and two girls in the Brashear family; with them, also, lived Mrs. Brashear's father. It was he who passed on to young John his love for the stars. This love was to be the guiding factor in John's life.

In 1855 John left Brownsville and went to Pittsburgh, where he attended a mercantile college. He was not satisfied there, nor with several other occupations he tried. In 1856 his father secured for him a position as an apprentice pattern-maker in Brownsville. Here his latent mechanical genius began to develop, and he finished his apprenticeship in three years.

John took an active interest in the church, and was considering becoming a minister. He went so far as to preach one sermon, but the minister made such slighting remarks about the young man's search for knowledge in the Bible, ordaining that the Bible was to be accepted blindly, that John never preached again. However, he remained a devout church worker all of his life.

This part of the church in his life was very important, for here he met Phoebe Stewart and married her on September 24, 1862. They were a most devoted couple. She gave him all the help in his work that any woman could. Without her, I do not think he would have risen to the heights that he did.

The seed which his grandfather had planted in young John's mind grew deep roots, for Brashear's interest in astronomy never died. When he built his own home, he rigged up a small workshop. He and "Ma" as he always called Mrs. Brashear, began the task of grinding a five inch telescopic lens. It took them three long years and a number of heart breaking failures to complete the first lens.

Armed with the experience gained and a desire to accomplish better things, Brashear went to see Professor Langely, a noted astronomer. Their contact began a lifelong friendship and helped Brashear immensely on his career as a maker of astronomical instruments.

Ma and Brashear continued to experiment with lenses, while he held his position as a millwright. After nine years of constant toil, he collapsed from overwork in 1881. By now he had gained a small reputation as a lens grinder, so that upon his recovery, with the aid of William Thaw, a philanthropist interested in astronomy, he built a new shop and quit his job as a millwright.

James B. McDowell, who was a glass worker by trade, and who had married the Brashear's eldest daughter, joined his father-in-law in his new shop. Their first major achievement was the manufacture of some Rowland diffraction gratings for use in spectrum analysis. Their work produced some of the most accurate gratings ever made. This was only the beginning of their scientific success. They made all kinds of lenses, prisms and delicate mechanisms during the next forty-five years. Brashear always insisted on the finest workmanship in their products in spite of the cost, but he was as inadept with money as he was adept with mechanics, so that the partnership would have gone bankrupt several times had it not been for Thaw and others.

In 1888, Brashear and Ma made their first trip to Europe, where his fame among astronomers was well established. They toured England, France, Switzerland and Germany. They were well received everywhere and Brashear's notable charm made many friends for him.

Several years after their return, Brashear again collapsed from overwork. He and Ma made another trip to Europe as a rest cure. When they returned, a new observatory, the Allegheny Observatory, was set up under Brashear's direction. It was a scientific monument to him, and was to aid in the mapping of the heavens.

Brashear and Ma now began to rest a little from their lifetime of hard work. They bought a small island in the Muskoka Lakes of Canada and spent their summer vacations there until September 23, 1910, when Mrs. Brashear died. They had been a truly devoted couple for forty-eight years.

As Brashear and his work became better known throughout the world, honors poured in upon him. He became Acting Chancellor of the University of Western Pennsylvania; was associated in the establishment of the Carnegie Institute of Technology; was, in spite of his lack of adeptness at finances, given control of a $250,000 fund for the betterment of the Pittsburgh grade schools; and was made president of the ASME in spite of his lack of formal education. Many, many other honors were his. He made a third trip to Europe, and also one to the Orient before he died.

His boundless energy carried him along to the last. He worked hard almost to the day of his death in 1920. His ashes were placed beside those of his wife in a crypt in the Allegheny Observatory. Their epitaph—and none could be more fitting—reads:

We have loved the stars too fondly
To be fearful of the night.

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GEORGE WESTINGHOUSE

By Harold Turner

George Westinghouse, the boy who was later to be called the greatest living engineer of his time (1846-1914), showed little promise to his stern father, owner of a machine shop in Schenectady. The boy had no interest in his school work and other laborsome tasks, a matter which worried his father even after George was married.

Always keenly interested in mechanical devices and mathematics, George enjoyed working in his father's machine shop. Working for his father probably had a greater influence on the development of his genius than his father's skepticism had on retarding it.

Westinghouse's future career began to unfold when he designed the air brake for railroad cars, when he was in his early twenties. In trying to convince various manufacturers of the marvelous possibilities of his newly designed brake, he encountered many discouraging obstacles. As in the case of many inventors trying to introduce new devices, he was laughed at, dismissed curtly, and even acquired the nickname of "Crazy George." One of the men who treated him thus was Commodore Cornelius Vanderbilt, biggest railroad man in the country at that time. Westinghouse was to get the last laugh, however, for in 1871, the Pacific Express, Vanderbilt's favorite train, met with a gruesome accident. Shortly after, the New York Central was equipping its trains with the Westinghouse air brake. It was not long before most major railroads in this and other countries were using the air brake.

Typical of Westinghouse was the realization that the air brake he had designed was not flawless, and typical was the effort of his to perfect the device. In a matter of about ten years he made two outstanding improvements on the brake. Finally, in 1886, he equipped a 50-car freight train with the perfected brake, and toured the country. Its engineer could stop it in half its length while going 40 miles an hour on a steep down-grade.

The railroad air brake was only one of Westinghouse's more spectacular achievements. He would have been hailed as a great engineer without the credit of the air brake. Between the period 1880-1890, he obtained 134 patents, or on the average of over one per month. He possessed a great faculty of seeing large possibilities in the principles of crude devices made by other inventors. In many cases, such as that of the electric transformer and the turbine, he bought the rights to patents shortly after they were issued and before they had been made practical. With his mechanical genius, he improved these devices or used their principles of operation, to bring forth to the public many things years before they otherwise could have been introduced.

George Westinghouse was the rival of Thomas Edison in the great battle between the new-coming alternating current and the established direct current electricity, on which

(Continued on Page 30)

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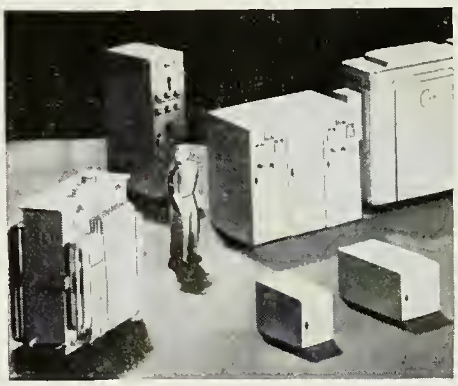

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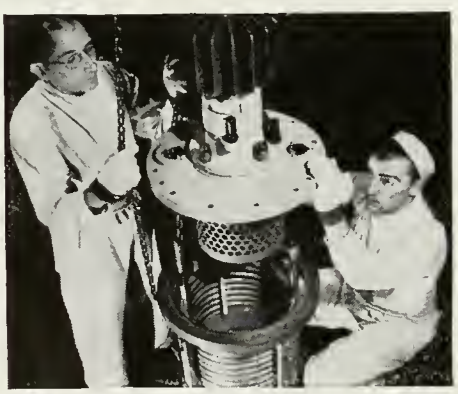

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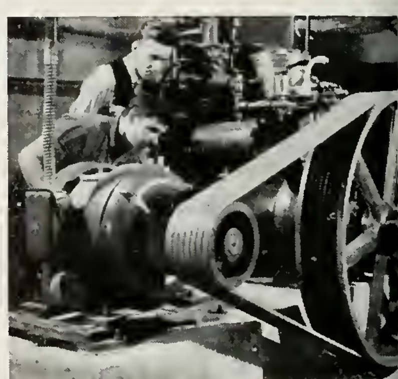

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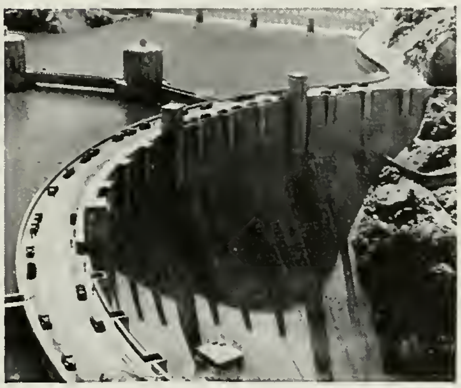

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THE IDEAL EDUCATION FOR AN ENGINEER

By Edward Bower, M.E. '45, V-12

Ever since I began to think about entering the engineering field, I've heard varying opinions on what an engineering student should get out of his college training. It seems that this disagreement can easily be straightened out of a thought is given to the aims of an engineering education. Should four years be spent in an effort to prepare students to be highly technical specialists, only—men who know only how to handle facts and figures? This would be missing the mark by a wide margin. Engineering really is a field in which leadership, as well as technical skill, is required. A century old definition of engineering embodies this fact: "Engineering is the art of organizing and directing men and of controlling the forces and materials of nature for the benefit of the human race." Too often engineers go forth to practice, having been trained only in "controlling forces and the materials of nature." As far as being leaders, executives, and professional men, they are as well equipped as plumbers. The field for engineers is continuously broadening out from such things as research and design to management, business, and other executive positions. Every day it is being proved that there is, and will continue to be, a great need for engineers capable of responsible leadership; therefore, engineering students should expect to get out of their four college years a background equipping them for such leadership.

The thing to consider now is how engineering students can be equipped for responsible leadership—what courses should he be offered or required to take? The fact cannot be disputed that leadership comes only from a well disciplined mind, from a sense of responsibility, and from learning to hink straight and quickly. These qualities are not absorbed as technical knowledge is absorbed. Education is a mental process, and the only way to broaden the mind is to place it in contact with something bigger than itself. This larger thing is represented by the best minds and the best thinking found in the past. (1) Knowing what the best minds are thinking, or have thought, the student is clear and settled on the way, the wherefores, the shortcomings, and the purposes of so many things in this life. By knowing and realizing these things, he is on his way toward attaining a disciplined mind, a sense of responsibility, and the quality of straight thinking.

Many educators would undoubtedly object considerably to the possibility of including cultural courses in the engineering curricula if such a proposal were advanced. Many measures could be taken, though, to make this possible. One suggestion is that many highly specialized courses now being given could be reduced in degree of specialization or relegated to the graduate field to make room for these needed courses. Or, a longer term of training could be required. Doctors and lawyers spend six to eight years training for their professions. Is there any reason why five or six years could not be required of engineers for positions of equal importance? The last measure, and the one which is being resorted to today, is to increase the number of subjects carried by a student in the standard four year period. Whichever measure would be best is a question. It is definite, however, that some step must be taken to include more cultural courses in the engineering curricula.

COLLEGE OF ENGINEERING . . .

(Continued from Page 10)

Who among the faculty and the students. In 1939-40 the Who's Who page was replaced with "Names in the News." During that year the publishers returned to the policy of issuing eight numbers and have continued to do so since.

For a number of years after 1894, the offices of the Tech were located in one of the rooms on the ground floor of Engineering hall. Since 1920, it has been in Room 213 on the second floor of the same building.

The printing of the early numbers was distributed among a number of publishing firms, including the Gazette of Champaign, the Champaign County Printing Company, and the Bloomington Pantagraph Printing and Stationery Company. In 1920, however, the printing work was taken over by the Illini Publishing Company and has been handled by that organization since that time.

The periodical, published practically continually from 1887 to date, sometimes aided by a small subsidy from the University, but generally by the sole efforts of the students, has always been of distinct advantage in stimulating students to write and in giving the staff valuable editorial and business experience. The Technograph has almost always followed the practice of printing only articles written by Illinois undergraduates, graduates, or members of the staff of the College of Engineering.

METAL CUTTING TEMPERATURES . . .

(Continued from Page 12)

thermocouple some distance away from the separating surface of the chip. Since this couple would be of lower temperature it would reduce the average indicated thermal emf. A more pronounced built up edge would cause a greater decreasse in average emf and vice versa. Thus, under unstable cutting conditions the indicated average temperature is somewhat lower than the maximum cutting temperature on certain areas of the separating surface. This probably accounts for the drooping characteristics of the cutting temperature curves at low speeds and/or feeds.

Conversely, under stable cutting conditions, as shown by a smooth chip, the indicated average cutting temperature is essentially the maximum temperature at the separating surface and it is likely that the entire separating surface is at practically the same temperature during the cutting operation.

Conclusions:

1. The Herbert-Gottwein couple has been applied to cemented carbide tools cutting steel and found to be reliable.

2. The cutting temperature at the separating surface increases with an increase in feed rate.

3. The cutting temperature at the separating surface increases with an increase in depth of cut within limits investigated.

4. The cutting temperature at the separating surface increases with an increase in speed in essentially an exponential relationship of the type $T=CV_n$.

5. The presence of a built up edge on the tool tip affects the indicated cutting temperature and from visual observation, the true cutting temperature as well.

6. Stable cutting, as shown by a smooth chip separating surface, is believed indication of desirable cutting conditions.

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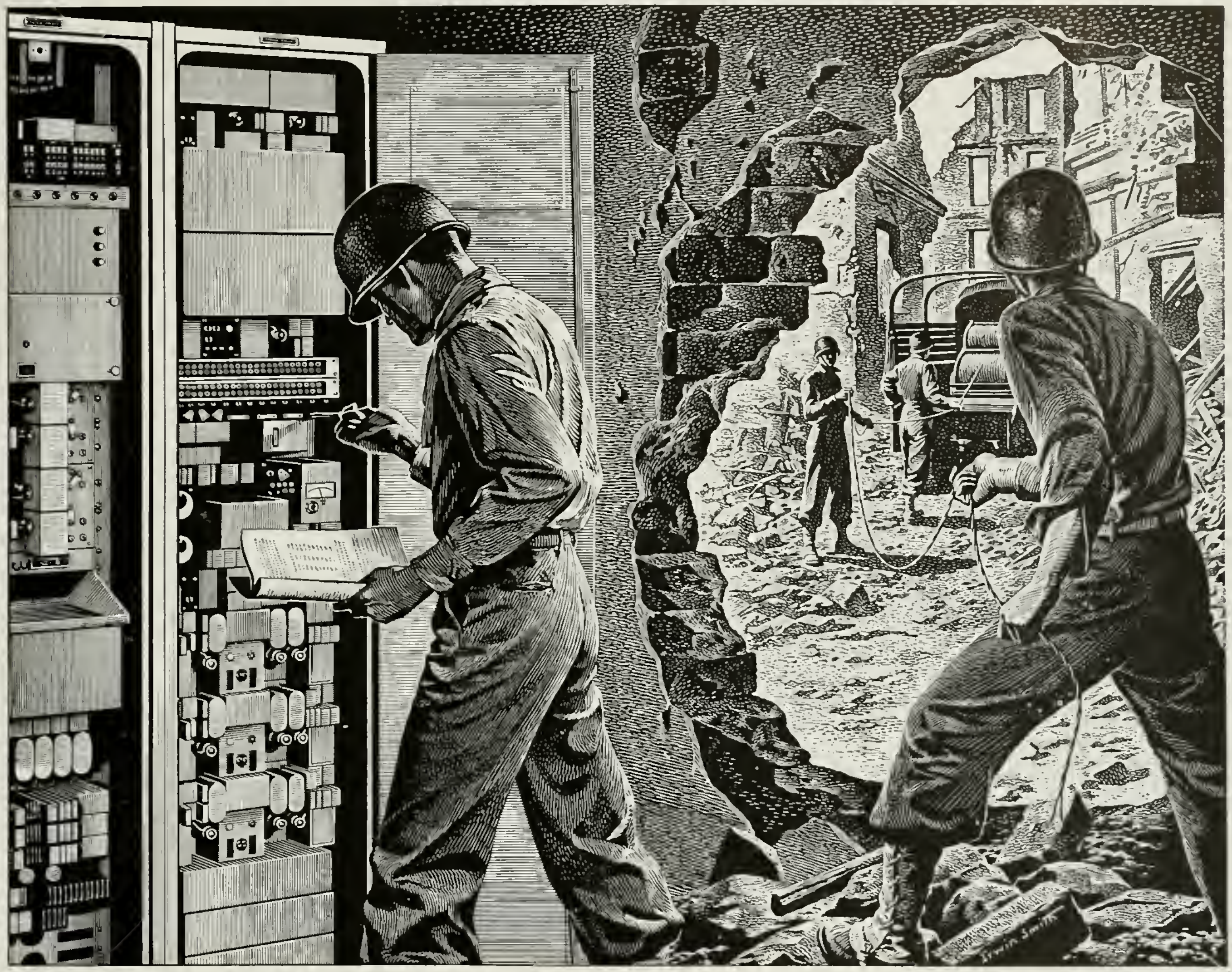

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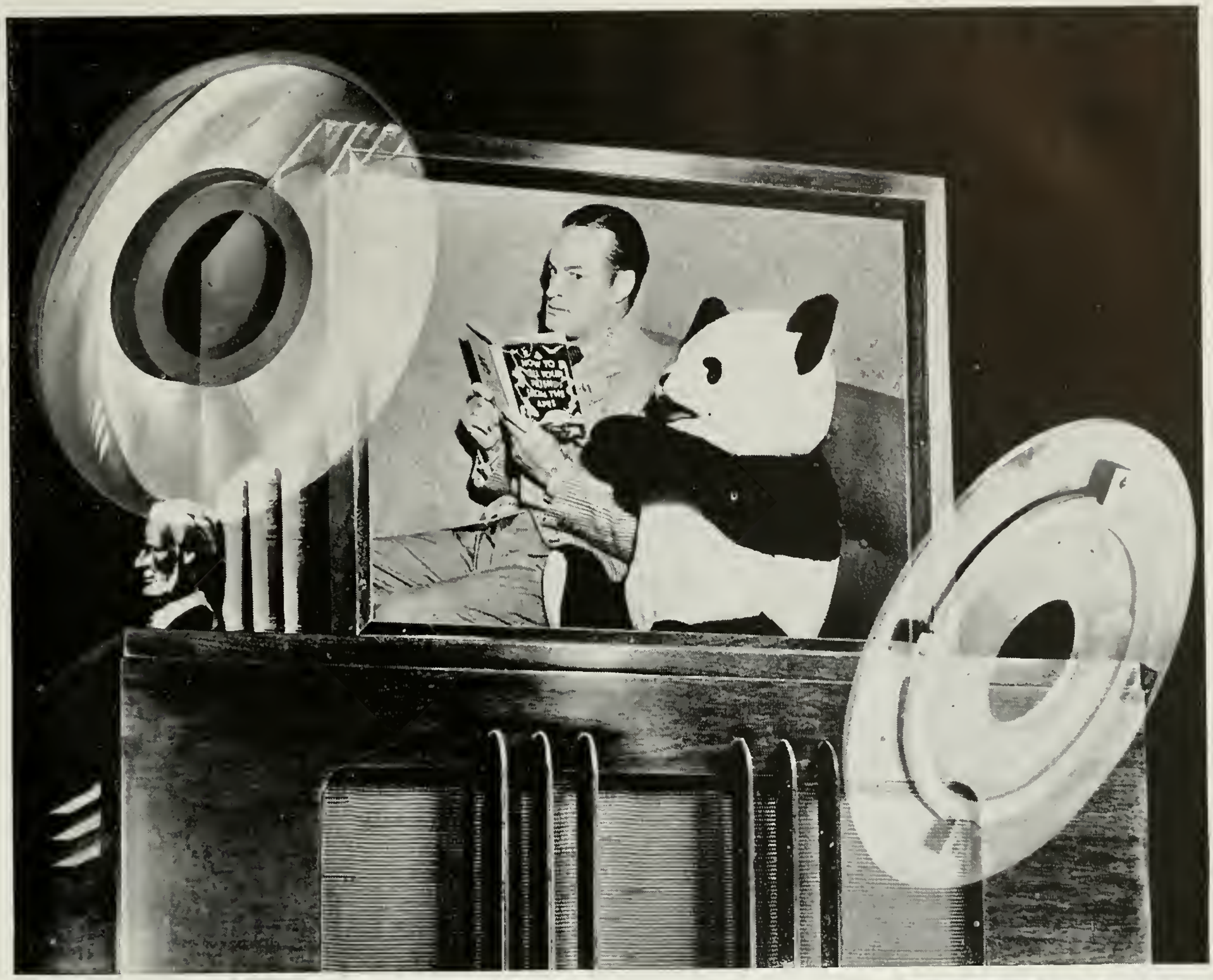

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When you tune in an NBC television broadcast you'll almost think the actors are in the same room with you—and trust NBC, America's No. 1 network in sound broadcasting, to bring you the best in television entertainment.

This revolutionary improvement was achieved in RCA Laboratories by development of an entirely new reflector and lens, shown in phantom above. This lens, of inexpensive plastic, is 8 times as efficient for the purpose as the finest optical lens.

When you buy an RCA radio, phonograph or television receiver—or any other RCA product—you receive the benefit of the latest research development of RCA Laboratories. It is this *plus value* which is your assurance of lasting satisfaction.

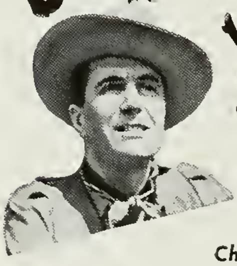
The widespread public recognition of this plus value has given to RCA world leadership in the radio, phonograph, television and electronic art.

Dr. D. W. Epstein with a projection television tube, reflector and lens unit. Here the image on the end of the tube hits the reflector, is corrected by the lens, projected to the screen, then enlarged . . . making possible larger and clearer television than ever before.

RADIO CORPORATION of AMERICA

PIONEERS IN PROGRESS RCA

COMING YOUR WAY



A New Kind of Horsepower is Changing Your World

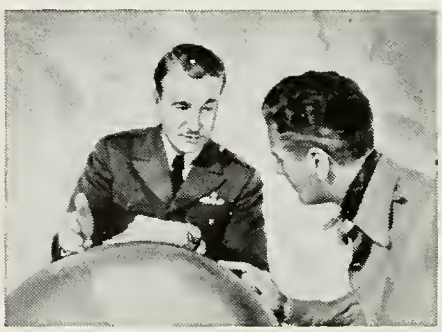
This is the story of what is likely the biggest thing that has happened in our time . . . of a new kind of power spreading throughout the world . . . of a new force affecting our lives, our outlooks, and our incomes as perhaps only electricity has done since the turn of the century.

1. Under the wing of a giant Lockheed Constellation, in the shadow of one of the big ship's four Wright Cyclones, two men talk. One is a veteran airline pilot who lives and works in a world most people haven't yet begun to know or understand or even to imagine! The other, a man who has seen a whole vast western section of America change in his lifetime as if by magic!

2. The Westerner operates a ranch that was literally made possible by power — electricity and irrigation from the great Boulder Dam harnessing the Colorado River. Power which made possible the conversion of millions of acres of barren wilderness into fertile ranches and farms!

3. No wonder he's eager to hear the pilot tell of a new super-power — such as that of the Wright Cyclone . . . the engine which speeds the great Boeing B-29 Superfortress across the air miles to Tokyo . . . power that makes possible a trans-Atlantic flight every 13 minutes.

4. Most efficient power plant in the world, today's Wright Cyclone packs a horsepower into less than a pound of metal. Four Cyclones develop more power than the mightiest locomotive operating in the Rocky Mountains . . . and already this new power is changing ranches and farms, business and homes . . .



5. These Cyclones help make possible the operation of U. S. transport planes over more than 110,000 miles of global air routes. For example, 1,800 cargo shipments daily leave a single U. S. airport, and millions of miles are daily flown by U. S. airlines and the Air Commands of our armed services.

6. Carrying our men, materials, ideals to the corners of the earth — breaking down barriers of distance — the Cyclone power of American aviation is changing the world you live in . . . right over your head!

AVIATION OFFERS A BRIGHT FUTURE FOR COLLEGE ENGINEERS: WRITE ENGINEERING PERSONNEL BUREAU, CURTISS-WRIGHT CORPORATION, PASSAIC, N. J.

LOOK TO THE SKY, AMERICA!

CURTISS WRIGHT

AIRPLANES • ENGINES • PROPELLERS

UNION CARBIDE *AGAIN* REPORTS

on the production of

BUTADIENE

for the Government's Synthetic Rubber Program

ONE OF THE MOST IMPORTANT factors in the Government's rubber program is the production of GR-S type synthetic rubber.

The basic chemical in this rubber is Butadiene, which can be made from alcohol or hydrocarbon materials.

The Government's original plan provided that about one third of the required Butadiene would be made by CARBIDE AND CARBON CHEMICALS CORPORATION'S alcohol process.

In 1943, their first year of operation, however, the plants using this process produced over 75 per cent of all Butadiene made for GR-S type synthetic rubber.

In 1944, the second year, these plants produced about 64 per cent of all Butadiene necessary for military and essential civilian rubber. This was true despite the fact that good progress had been made in the production of Butadiene by other processes.

THE RECORD

The first tank-car load of Butadiene was shipped from the Government's Carbide-built, Carbide-operated plant at Institute, West Virginia a little over two years ago.

This was just five months after the famous Baruch Committee Report pointed out this nation's desperate need for rubber—and approved Carbide's butadiene alcohol process, originally selected by Rubber Reserve Company, as one of the solutions.

In its first year the Institute plant, with a rated capacity of 80,000 tons per year, produced enough Butadiene for more than 90,000 long tons of synthetic rubber.

Two more great plants using Carbide's alcohol process—and built from the blueprints of the Institute plant—are in full production. One of these, with an annual rated capacity of 80,000 tons of Butadiene is located at Kobuta, Pennsylvania and is operated for the Government by another important chemical company.

The second, with a rated capacity of 60,000 tons a year, is operated for the Government by Carbide at Louisville, Kentucky—making the total rated capacity of the two huge plants now operated by Carbide 140,000 tons a year.

In 1944, the production of Butadiene from the three plants using the alcohol process totaled 361,000 tons—representing operation at over 164 per cent of rated capacity. An even higher rate is expected in 1945.

* * * * *

Before Pearl Harbor, the United States was a "have not" nation with respect to rubber. Now, thanks to American research, engineering and production skill, our country can take its place as a dominant factor among the great rubber producing nations of the world.

▼

Business men, technicians, teachers, and others are invited to send for the book P5 "Butadiene and Styrene for Buna S Synthetic Rubber from Grain Alcohol," which explains what these plants do, and what their place is in the Government's rubber program.

SEPTEMBER 10, 1942

"Of all the critical and strategic materials, rubber is the one which presents the greatest threat to the safety of our nation, and to the Allied Cause.... We find the situation to be so dangerous that unless corrective measures are taken immediately the country will face both a military and a civilian collapse."

—Report of the Rubber Survey Committee (Baruch Committee).

AUGUST 31, 1944

"Undoubtedly the outstanding achievement of your company has been the development of your process for the production of Butadiene from alcohol. With a rather meager background of experimental work, your engineers were able to design and construct commercial units for the production of Butadiene. In an exceedingly short time, the operation of this equipment at capacities up to 200 per cent of rating has been largely responsible for our present safe situation with respect to rubber supplies..."

—Letter from Rubber Director Bradley Dewey to CARBIDE AND CARBON CHEMICALS CORPORATION

The material herein has been reviewed and passed by the Rubber Reserve Company, the Defense Plant Corporation, and the War Department.

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York 17, N. Y.

Principal Units in the United States and their Products

ALLOYS AND METALS—Electro Metallurgical Company, Haynes Stellite Company, Kemet Laboratories Company, Inc., United States Vanadium Corporation
CHEMICALS—Carbide and Carbon Chemicals Corporation **PLASTICS**—Bakelite Corporation **ELECTRODES, CARBONS & BATTERIES**—National Carbon Company, Inc.
INDUSTRIAL GASES AND CARBIDE—The Linde Air Products Company, The Oxweld Railroad Service Company, The Prest-O-Lite Company, Inc.

Willie: "Say Pop, did you go to Sunday School when you were a boy?"

Father: "Yes son, regularly. Never missed a Sunday."

Willie: "Well, I'll bet it won't do me any good either."

Barber: "Was your tie red when you came in?"

Customer: "No, it wasn't."

Barber: "Gosh!"

"I draw the line at kissing,"
She said in accents fine;
But he was a football hero,
So he crossed the line.

Starkle, starkle, litle twink,
Who the hell you are, I think.
I'm not under the alchofluence of inkohol,
Though some tinkle peep I am.

"Are you sure he was intoxicated?"

"No, sir, not positive, but his wife said he brought home a manhole cover and tried to play it on the victrola."

A censor is a lovely man—
I know you think so too:
He sees three meanings in a joke—
When there are only two!

"Where's the First Sergeant?"

"He's over in the barracks hanging himself."

"Did you cut him down?"

"No—he wasn't dead yet."

I guess they call a sailboat "she" because it makes a better showing in a breeze.

BIOGRAPHICAL SKETCHES . . .

(Continued from Page 15)

the Edison General Electric Company depended. If Westinghouse ever enjoyed any honor given him, it was the third award of the Edison Medal, a medal founded in honor of Thomas Edison by his associates.

George Westinghouse was a great organizer and business man as well as inventor and engineer. His companies grew in number and size, and he was well known for his generosity and for the good treatment of his workers.

Westinghouse lived a vigorous life. Even after retirement, which was ordered by his physician, he played the part of an inventor. In 1914, at the time of his death, he was busily designing an improvement on his recent means of motivation: the wheelchair. The electrically mechanized wheelchair would permit the patient to rock, wheel, raise or lower himself to any desired position.

Their love for George Westinghouse was reflected in the donation of $200,000 by 60,000 Westinghouse workers. The memorial was unveiled in Pittsburgh, Schenley Park in 1930. Depicted on the memorial are his six most outstanding achievements: the illumination of the Chicago World's Fair, the air brake, automatic signalling devices, railway electrification, steam-electric power, and hydro-electric power. An American youth stands inspired by the inventor. The last words on the inscription read: "His achievements were great, his energy and enthusiasm boundless, and his character beyond reproach: a shining mark for the encouragement of American youth."

ENGINEERING HONORARIES . . .

(Continued from Page 11)

years of age and must have done particularly noteworthy work in his field.

Men enrolled in the electrical engineering course and who have maintained at least a 4.0 average are eligible to membership in Eta Kappa Nu. However, scholarship alone is not sufficient to guarantee membership, since the candidate must have the personality and promise that indicates a successful engineer. A unanimous vote of the active chapter is necessary to elect a candidate to membership.

PI TAU SIGMA

Pi Tau Sigma is the honorary goal of all mechanical engineers. To be considered for membership, the student must have at least a 4.0 average, although usually a higher standard is maintained by the chapter. As with the other honoraries discussed, scholarship is only one consideration in the election of a man to membership. He must also possess, in the eyes of the chapter, all the requisites that make a good engineer.

Honorary fraternities of mechanical engineering were founded simultaneously in 1915 at the Universities of Illinois and Wisconsin. When the two groups became aware of the existence of each other, steps were taken in 1916 to merge the fraternities. This was accomplished, and the name of the Illinois chapter, Pi Tau Sigma, was retained, with Illinois and Wisconsin both maintaining Alpha chapters. The fraternity now has about thirty-five active chapters in most prominent engineering schools.

These comprise the list of active undergraduate honoraries for engineers. In normal times, many more were active in the other engineering schools, but the great drop in enrollment has forced them to suspend activities until once again, a large enrollment returns to our campus. This inactivity is only temporary, however, and as soon as possible, these organizations will again begin their worthwhile activities.

The benefit of honor societies is unquestionable. Aside from their value in merely recognizing good work, they are of definite value in encouraging better work from students who otherwise might not strive so hard. The fraternities help the graduate in establishing ties with his scchool, profession, and with other men in his field. Most of these societies also help the graduate to locate good positions—employers are impressed by membership which the applicant may have held in colege honoraries. Finally, the honorary fraternities help their respective engineering fields through cooperating with professional organizations, publishing articles, holding conventions and lectures, and encouraging individual enterprise.

It is hoped that the engineering student may become better acquainted with the honorary fraternities to which he is eligible, and perhaps work a little harder towards achievement of distinction and honor for himself and his profession.

A Scotchman was engaged in an argument with a bus conductor over the fare. The Scotchman believed the fare was five cents. The conductor insisted upon a dime. Becoming disgusted, the conductor seized the Scotchman's suitcase and threw it off the car into a small stream over which the car was passing.

"Mon," screamed the Scotchman, "isna enough you overcharge me wi'out drowning my little boy?"

* * *

She: "I don't believe you know what good clean fun is."
V-12: "I must admit I don't, what good is it?"

* * *

"I'd like to be cremated, but I'm sure my wife wouldn't like it."

"Why not?"

"She's always complaining about my leaving my ashes around."

* * *

A new musical production came to town. The billboards read: "50 beautiful girls—45 gorgeous costumes."

Three students and two policemen were trampled in the rush at the opening performance.

* * *

Heard on the beach: "My goodness, isn't that Fanny Brown over there?"

* * *

Coed: "I said some very foolish things to Bob last night."
Second coed: "Yes?"
Coed I: "That was one of them."

* * *

You can never tell how far a couple in a car have gone by the speedometer.

* * *

"I'll never go anywhere again with you as long as I live."

"And why not?"

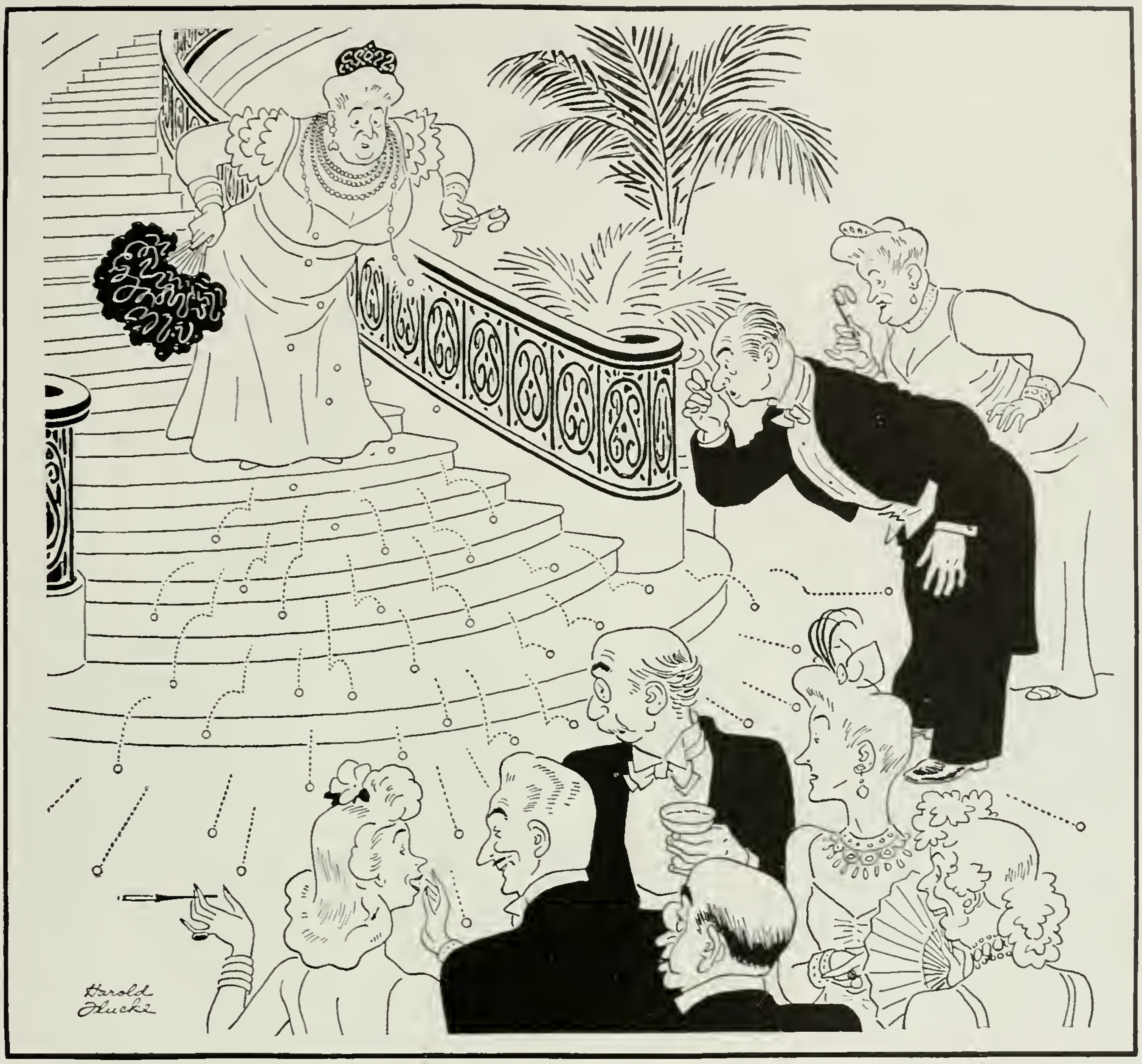
"You asked Mrs. Smith how her husband was standing the heat and he's been dead two months."

* * *

"I'd better warn you—my husband will be home in an hour."

"But I've done nothing I shouldn't do."

"Well, I just wanted to warn you that if you're going to, you'd better hurry."



A Taste of Home

Perhaps he is thinking of the corner drug store and the old gang talking football prospects over a dish of vanilla . . . or a farmhouse kitchen and a family at supper together.

But some of these things are not as far from the lads in the remote South Pacific as you may think. Wherever possible, fresh meat, vegetables—yes, even ice cream from home are brought to them through the miracle of refrigeration and a miracle of American engineering ingenuity!

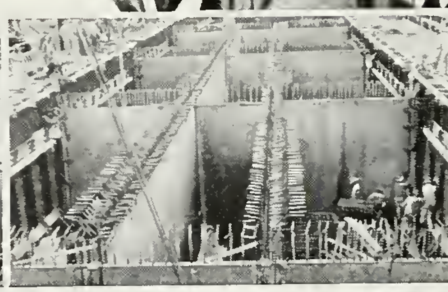
Concrete "Reefer" barges—285 feet of floating refrigerator—planned, engineered and built on the beaches by Concrete Ship Constructors, United Fruit Company and York Corporation have saved six months of ship building time—proved again that, in a crisis, America knows how to "do the best with what she has."

Refrigeration Looks Forward

The experience and engineering ability which are now making these achievements possible will one day return to the problem of broadening and improving the distribution of refrigerated foods by land, sea and air. But these things must wait for Victory . . . Only when it is an *accomplished fact* can York workers and York distributors turn to the job of satisfying the pent-up needs of a peacetime world.

York Corporation, York, Pennsylvania.

MIRACLE OF SPEED! Just six days after keel laying this concrete "reefer" was launched. The photo above was taken a little more than an hour after construction started.



ANSWER TO THE SHIPPING PROBLEM. With shipways crowded to capacity, Concrete Ship Constructors, United Fruit Co. and York Corporation engineered and built barges on the beaches.

FIRST FLOATING REFRIGERATOR puts to sea . . . the *USS Hydrogen* heads for the South Pacific.

york refrigeration air conditioning

YORK REFRIGERATION AND AIR CONDITIONING

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

In a field hospital, a SURGEON uses a new x-ray machine that marks the exact location of the bullet, speeds life-saving behind the battle line.

. . . the name on the X-RAY MACHINE is Westinghouse.

In a laboratory an ENGINEER uses the instantaneous power of 75,000 thunderbolts to test giant circuit breakers that protect America's power systems.

. . . the name on the CIRCUIT BREAKER is Westinghouse.

In his tent a SOLDIER uses a bug bomb to destroy insect life – safeguarding health and increasing comfort in tropical jungles.

. . . the name on the BUG BOMB is Westinghouse.

In a war plant a WORKER uses an electro-magnetic device to detect flaws in heat-treated bearing races – keeping our combat vehicles rolling on to victory.

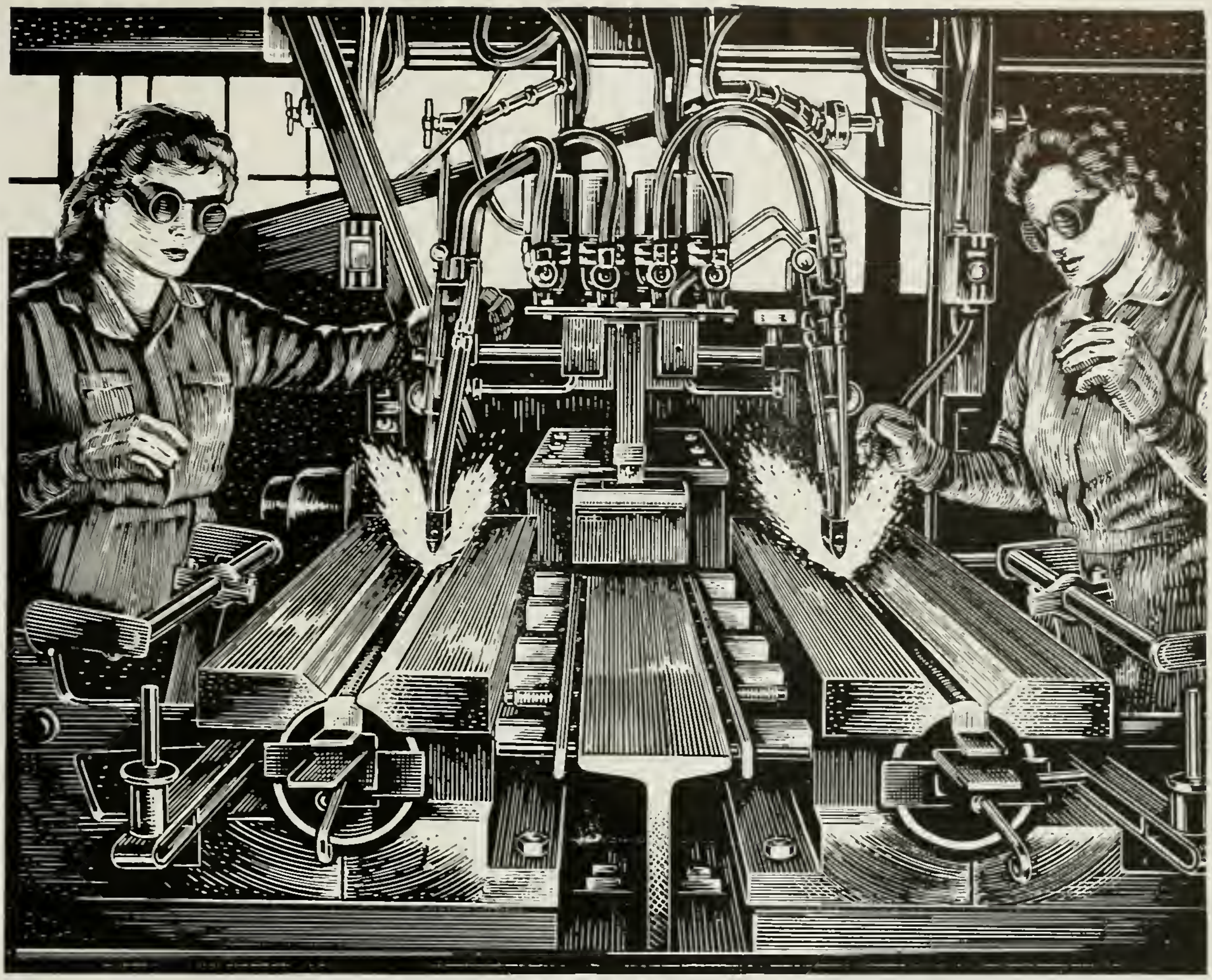
. . . the name on the ELECTROMAGNETIC DEVICE is Westinghouse.

Westinghouse
PLANTS IN 25 CITIES OFFICES EVERYWHERE

TODAY—Westinghouse products are serving in every battle, on every front, in the war against aggression.

TOMORROW—New processes and new materials...created under the stress of war . . . will mean better and longer-lasting Westinghouse products for a world at peace.

Tune in: JOHN CHARLES THOMAS—Sunday 2:30 pm, EWT, NBC. TED MALONE—Mon. Tues. Wed. Evening, Blue Network



Courtesy Wheeling Steel Corporation