Spartan ENGINEER

SCHOOL OF ENGINEERING, MICHIGAN STATE COLLEGE

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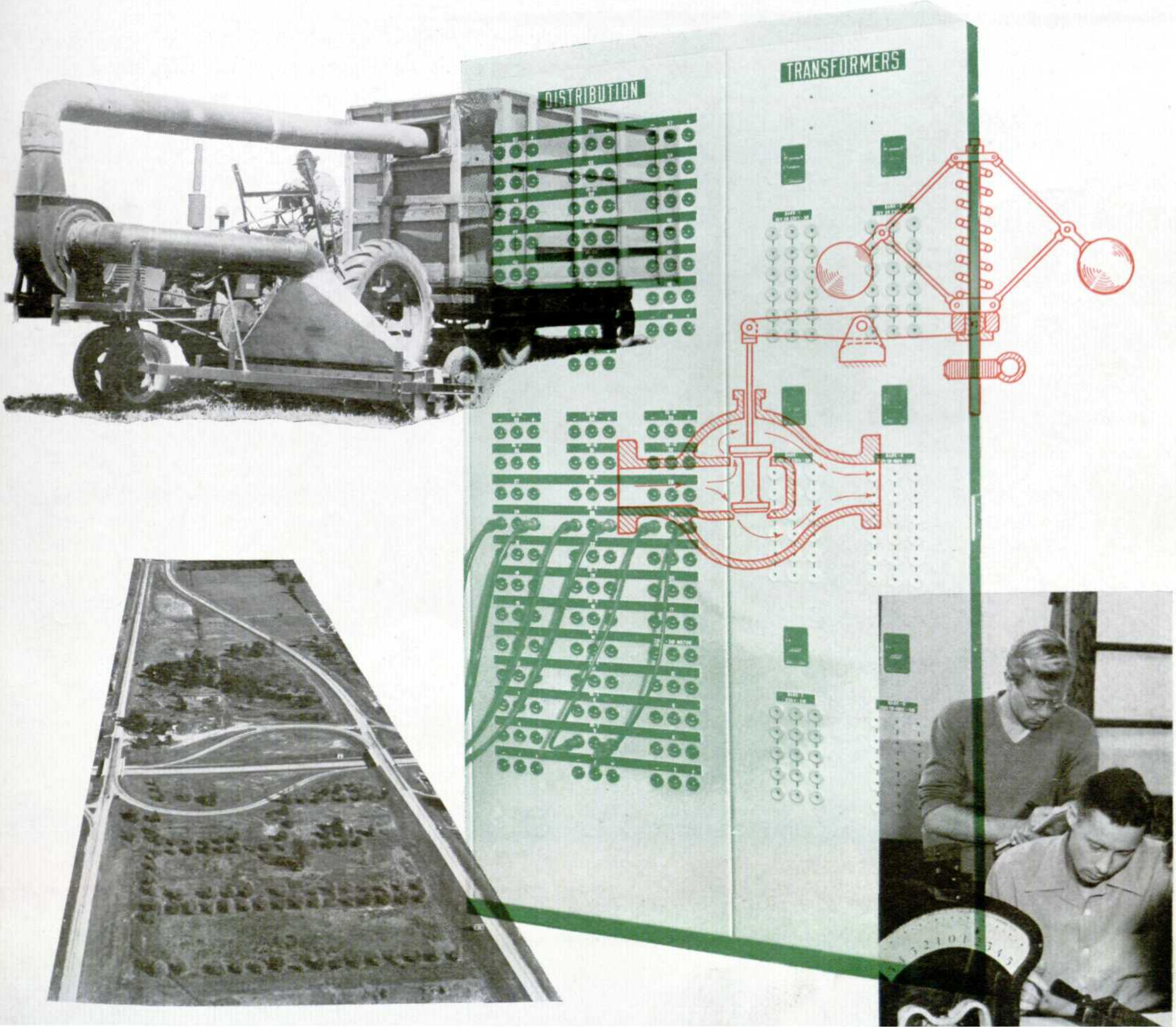
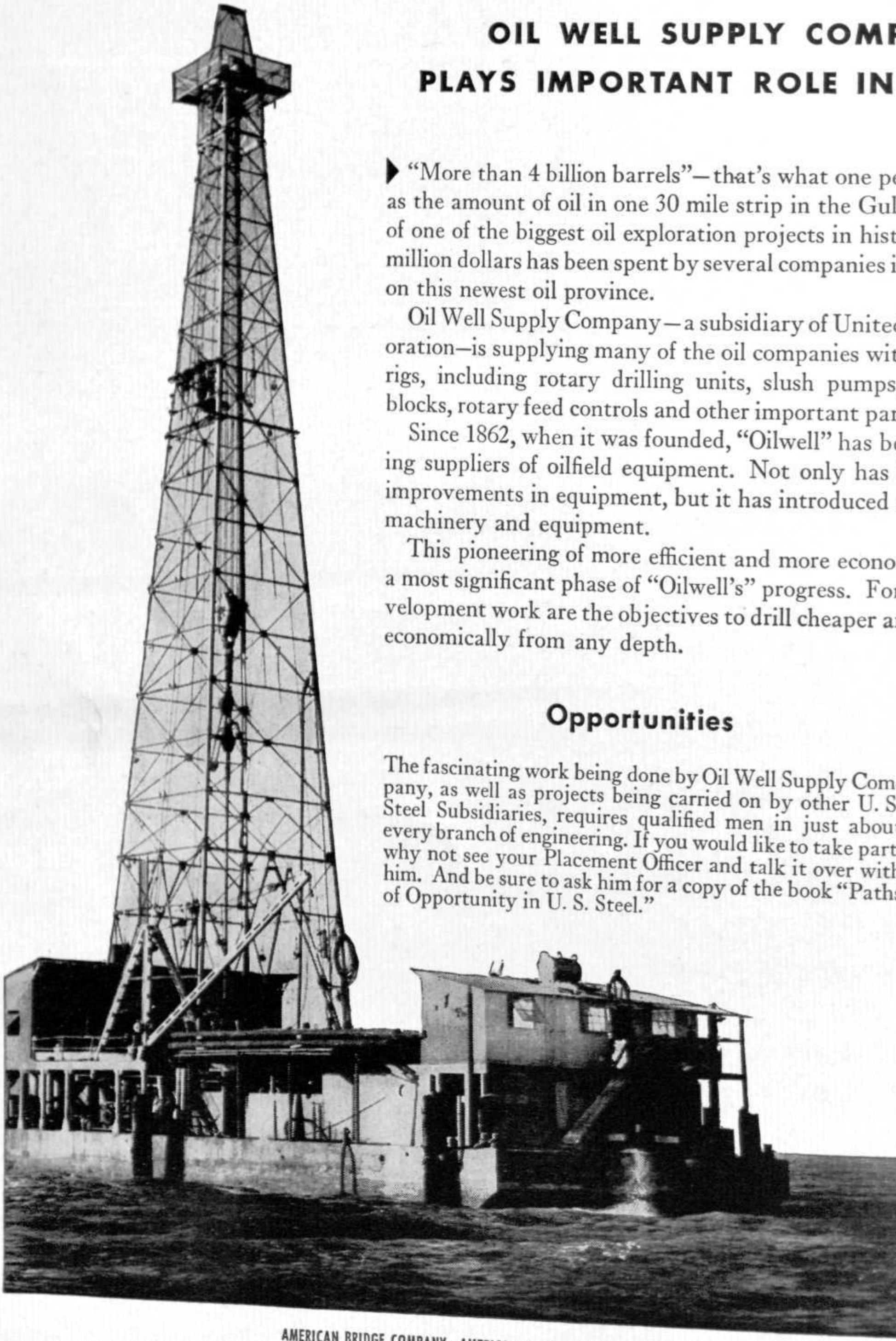


Gulf of Mexico is site of newest oil "boom"



OIL WELL SUPPLY COMPANY PLAYS IMPORTANT ROLE IN PROJECT

▶ "More than 4 billion barrels"—that's what one person has estimated as the amount of oil in one 30 mile strip in the Gulf of Mexico—scene of one of the biggest oil exploration projects in history. More than 20 million dollars has been spent by several companies in leasing properties on this newest oil province.

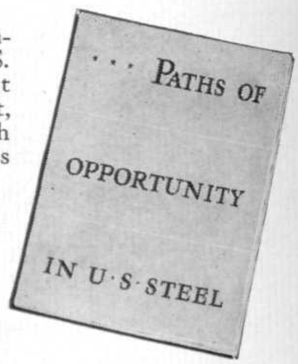
Oil Well Supply Company—a subsidiary of United States Steel Corporation—is supplying many of the oil companies with complete drilling rigs, including rotary drilling units, slush pumps, derricks, swivels, blocks, rotary feed controls and other important parts of rigs.

Since 1862, when it was founded, "Oilwell" has been one of the leading suppliers of oilfield equipment. Not only has it pioneered many improvements in equipment, but it has introduced many new types of machinery and equipment.

This pioneering of more efficient and more economical equipment is a most significant phase of "Oilwell's" progress. For back of all the development work are the objectives to drill cheaper and to produce more economically from any depth.

Opportunities

The fascinating work being done by Oil Well Supply Company, as well as projects being carried on by other U. S. Steel Subsidiaries, requires qualified men in just about every branch of engineering. If you would like to take part, why not see your Placement Officer and talk it over with him. And be sure to ask him for a copy of the book "Paths of Opportunity in U. S. Steel."



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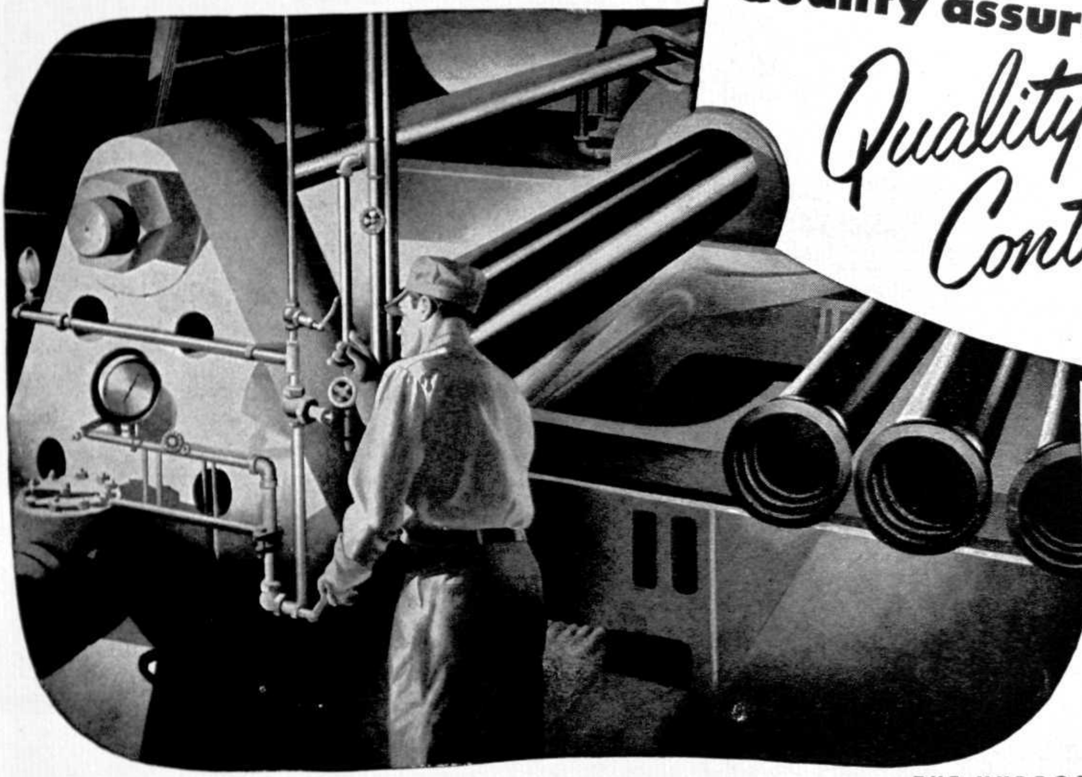
UNIVERSAL ATLAS CEMENT COMPANY · VIRGINIA BRIDGE COMPANY

UNITED STATES STEEL

Quality assured by *Quality Control*



THE HYDROSTATIC TEST

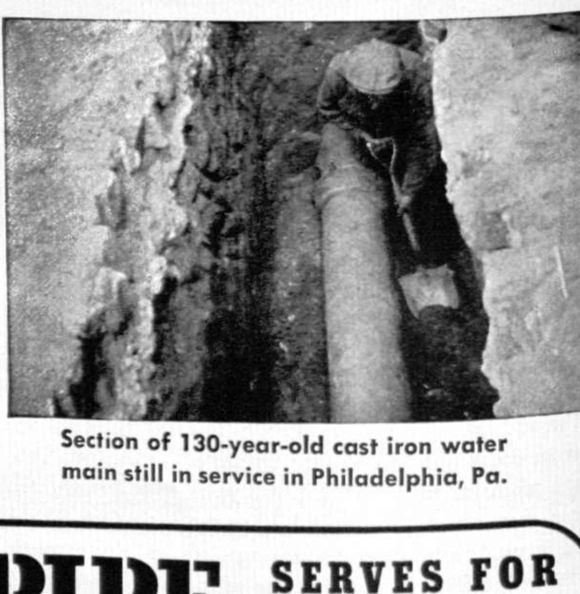
Nobody can buy a length of cast iron pipe unless it has passed the Hydrostatic Test at the foundry. Every full length of cast iron pipe is subjected to this test under water pressures considerably higher than rated working pressures. It must pass the test or go to the scrap pile.

The Hydrostatic Test is the final one of a series of routine tests made by pipe manufacturers to assure that the quality of the pipe meets or exceeds the requirements of standard specifications for cast iron pressure pipe.

Few engineers realize the extent of the inspections, analyses and tests involved in the quality-control of cast iron pipe. Production controls start almost literally from the ground up with the inspection, analysis and checking of raw materials—continue with constant control of cupola operation and analysis of the melt—and end with inspections and a series of acceptance and routine tests of the finished product.

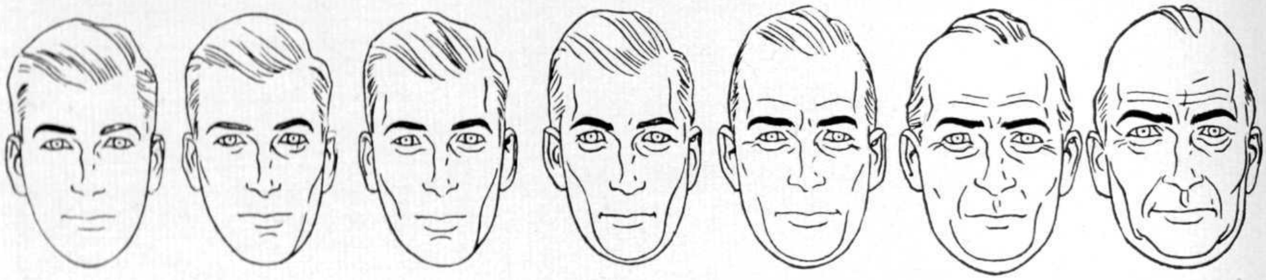
Members of the Cast Iron Pipe Research Association have established and attained scientific standards resulting in a superior product. These standards, as well as the physical and metallurgical controls by which they are maintained, provide assurance that cast iron pipe installed today will live up to or exceed service records such as that of the 130-year-old pipe shown.

Cast iron pipe is the standard material for water and gas mains and is widely used in sewage works construction. Send for booklet, "Facts About Cast Iron Pipe." Address Dept. C., Cast Iron Pipe Research Association, T. F. Wolfe, Engineer, 122 So. Michigan Ave., Chicago 3, Illinois.



Section of 130-year-old cast iron water main still in service in Philadelphia, Pa.

CAST IRON PIPE SERVES FOR CENTURIES



CORNING... DOES THE UNBELIEVABLE WITH GLASS

A new kind of light

where it will lead nobody knows

Soon it will be possible for you to step into your home or office and turn on a light that's different from any you've ever used before.

From a panel in the ceiling will come even, glareless rays to shine on your desk, your chair, your table—but never with uncomfortable brightness, never in your eyes.

The light itself will come from electric bulbs or tubes like those you use now. But it will *behave* far differently because it will shine through a ⅛-inch sheet of a new kind of glass—Fota-lite—a recent development of Corning Glass Works.

Formed inside this sheet is a crisscross pattern of strips of white glass extending through the full thickness of the glass. The squares enclosed by the white strips are crystal clear.

Light from the bulb above—shining through this patterned glass at slantwise angles—is diffused and causes no glare. You get an even, soft light through the entire room—as well as light channeled directly downward through the clear squares to the objects you need to see closely.

This new glass is made by mixing small amounts of rare metals in with the sand before it is melted to form glass. These materials make the whole sheet of glass photo-sensitive—through and through—so that any desired design (such as the one mentioned) may be formed inside the glass by a special process.

In fact, similar photo-sensitive glass is currently being used to print photographs in glass—pictures that can last for thousands of years.

Use of Fota-lite for indoor lighting is its first industrial application. Many other applications—such as its use in instrument panels for cars, in street lighting, and in illuminated signs—are being thoroughly explored.

In 98 years of glass-making Corning has developed glass into one of the most versatile engineering materials there is. There are more than 50,000 glass formulas on file at Corning, and the number is growing continually as new developments such as this photo-sensitive glass come out of the laboratory.

That's a good thing for you to remember. For some day, when you've picked the business you want to work in, one of these glass developments—or one now in the research stage—may be just the material you'll be looking for to improve a product or a process.

CORNING GLASS WORKS
CORNING, NEW YORK.

Spartan ENGINEER

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Frontispiece: Courtesy of General Motors

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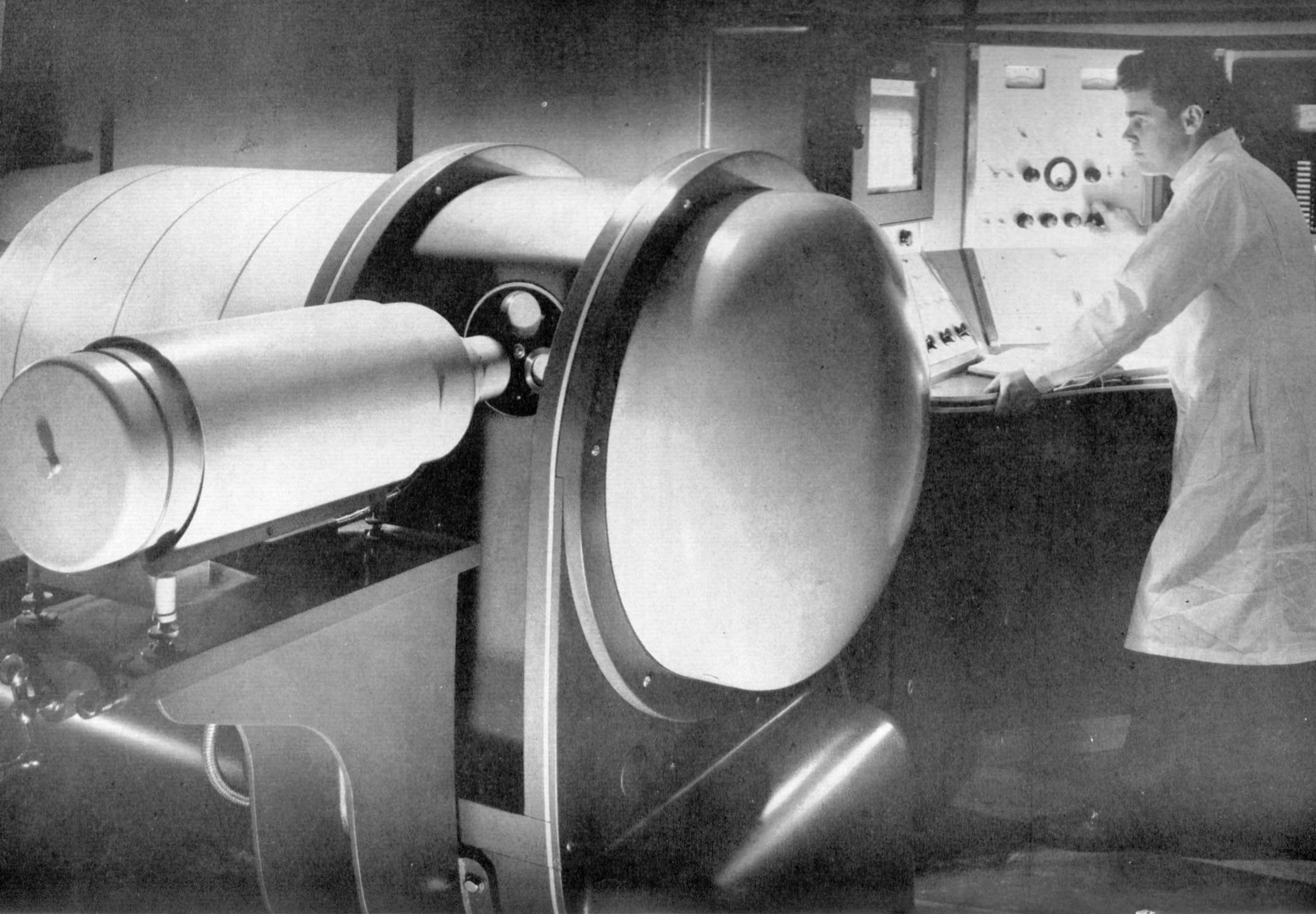

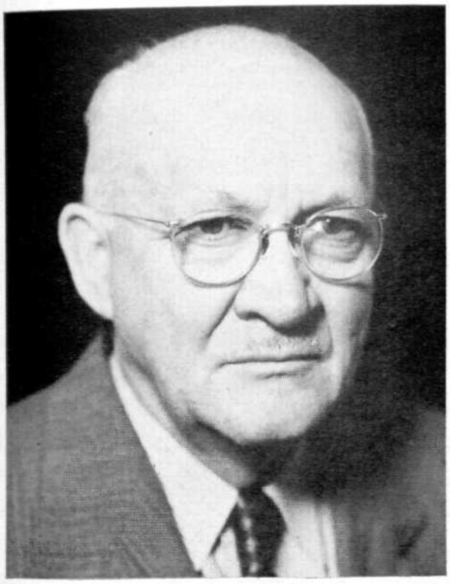

Professor Cade

WE PRESENT

WITH THIS ISSUE we present another Michigan Agricultural College graduate. Professor C. Marshall Cade graduated with the Aggies in 1907 as a mechanical engineer. His sheepskin was handed to him by President Theodore Roosevelt.

He first went to work as a heating and ventilating engineer, and received the assignment of mapping the location of all the machines in Henry Ford's factory, preparatory to installing a blower system. Ford's factory was so small at that time that the job was finished in two hours.

A short time later Professor Cade decided that surveying was more to his liking so he took a job with the U. S. Coast and Geodetic Survey.

Do you know how far it is across Texas? Professor Cade says it is 625 miles, and he ought to know—he walked from Fort Worth to El Paso making the official survey himself. The job took from April until the following February to complete. For convenience, the group followed a railroad carrying their equipment on a handcar, which Professor Cade remarks was practically as bad as walking. The men camped where they had finished surveying for the day, until one day they ran into a Texas sandstorm. The sand was blowing so fiercely visibility was limited to about thirty feet. Luckily, the men came upon an old ghost town and holed up in the railroad station for a full day before the wind slowed down enough to make travel possible again.

In west Texas, Professor Cade's party surveyed through seemingly useless areas, where shortly after large quantities of oil were discovered. "If I had only known some geology!", reflects Professor Cade.

"Join the Coast and Geodetic Survey and see the world" would seem to be good advice for young engineers with a yearning for travel and adventure. Within five years of the time Professor Cade surveyed the oil lands of Texas, he had been in nearly all of our forty-eight states; had surveyed the harbor for the Copper River Railroad in Alaska during the gold rush; and had worked in the Panama Canal Zone.

Along more conventional lines, Professor Cade taught at Purdue for one year after his graduation from Michigan Agricultural College. It was there that he became interested in statistics, which he says has many applications to engineering. By use of statistics he has devised a chart which predicts the enrollment of Michigan State College to a surprisingly close degree, especially when the effect of the unforeseen G. I. Bill is considered.

After leaving the Coast and Geodetic Survey, Professor Cade returned to Michigan State College in 1913 for an advanced degree in civil engineering. This was followed by teaching civil engineering and part-time study for a master of arts degree in economics and mathematics.

Upon completion of this advanced work, Professor Cade continued teaching civil engineering, but enjoyed practical engineering work too much to drop it altogether. He was for several years Assistant City Engineer of Lansing and later consulting engineer for the Michigan Department of Conservation. Two of his projects nearby, are the Wolf Lake Fishery and Hatchery, which is one of the largest fisheries in the country.

One of his recent achievements was his work for the Michigan Joint Survey Commission. Professor Cade and Mr. Eddy, state geologist, were appointed by the governor to represent Michigan in the establishment of a boundary in Lake Michigan between Wisconsin and Michigan, and between Minnesota, Wisconsin, and Michigan in Lake Superior. These boundaries are located by reference to the stars, and according to Professor Cade find one of their principle use in cases of law. In the event that a crime was committed aboard ship on Lake Michigan it would be necessary to determine in which state the crime had actually occurred so that the proper laws might be applied.

Although Michigan State College does not have a summer camp for surveying instruction, through the years Professor Cade has given many student engineers the opportunity for experience on summer jobs with him.

RETIREMENTS

Professor Allen

ONE OF THE most congested waiting rooms on campus is located outside Prof. Allen's office, with the reason for the congestion fairly obvious. It is, of course, Prof. Allen's practice of making himself available and establishing himself as a friend, advisor and teacher to every civil engineering student who desires his help. This element of friendship is not restricted to his office, but is noted in the classroom, in the halls, and on the street—wherever the nattely dressed professor has an opportunity to present his friendly, unruffled personality.

Chester Lawrence Allen was born in Boston, Massachusetts, in 1884. A graduate of Massachusetts Institute of Technology, where he received his B.S., Prof. Allen received an honorary C.E. from Lafayette College and an M.S. from Pennsylvania College in 1917. Previous to his graduate work, however, he received a great deal of experience in private industry. First in 1903, he served as a resident engineer for the C.C.C. and St. L. Ry. when it tied Gary, Indiana (U. S. Steel was just building the city) in with the coal fields of Harrisburg, Illinois.

Another project the professor remembers while working with the C.C.C. and St. L. Ry. was the construction of thirty miles of railroad between Evansville, Indiana, and Mt. Carmel, Illinois. This involved building a 1500 foot bridge over the Wabash River, where he again served as resident engineer. Following his tenure with the railroad Prof. Allen was in the order named: a construction engineer with the Zenas Crane Co.; an instructor and assistant professor at Pennsylvania State College; professor and head of department of Pennsylvania College, and in 1918-19 designer and later material expediter for the construction of a shell loading plant for the Atlantic Loading Company.

In 1919, Prof. Allen became an assistant professor and in 1925 professor and head of the Civil Engineering Department at Michigan State College. While in this position, he served as a member and six years as president of the Michigan Board of Registration for Architects, Engineers, and Surveyors. He was, also, for fourteen years city engineer of East Lansing and a member and one time president of the East Lansing School Board.

While most everybody who has had an opportunity to observe, is struck with the changes wrought at Michigan State College during the past thirty years, Prof. Allen is impressed with the things that haven't changed. For instance, he notes couples still stroll hand in hand, the same bustle exists at graduation time, and every fall the same rumor describes a fine football season ahead.

Professor Allen's own words best describe the satisfaction he has found while teaching at Michigan State College. While discussing his forthcoming retirement he stated, "For thirty years I have watched the engineers of M.S.C., come and go, starting as freshmen, going through four years of training and then continuing the practice of the profession all over the world. Some of the students now in school are sons of men whom I started on their career years ago. I have spent the best years of my life at State and now I will soon retire. What a satisfaction it is to have had some part in the education of 7500 alumni. What a privilege to have been associated with so many fine young men and to have helped them if only a little."

Professor Cory

SOFT SPOKEN and well liked Prof. Cory has finally found it necessary after 37 years at Michigan State College to be relieved of his teaching duties in order to devote his full time to the duties required of him as national president of Tau Beta Pi. During his 37 years hundreds of students and members of the faculty have come to know him as a tireless worker, anxious to get things accomplished, but in the role of an organizer and prime mover behind the scenes. In this light his election to the presidency of Tau Beta Pi is a high tribute to his ability and previous endeavours.

Merton Maine Cory was born in Nashau, New Hampshire, in 1882. In 1908 he received his B.S. from the University of New Hampshire and later his M.S. from the University of Michigan.

Following his graduation Prof. Cory spent two years with the General Electric Corporation, where he conducted tests on small motors and generators, arc lamps, meters and instruments, railway motors, transformers, turbines and turbine generators. Prof. Cory came to Michigan State College from the Commercial Engineering Department of the Milwaukee Electric Company, where he had made a study of changing from private plant operation to public utility operations.

Besides being President of Tau Beta Pi, Prof. Cory is past Chairman of the Michigan Section AIEE, and a fellow of the organization. He is listed in "Who's Who in Engineering" and "Who's Who in Michigan." For a number of years, as a member of the Graduation Committee, he has had charge of the commencement procession and has been a member of the Calendar and Farmers' Week Committees. He is also past president of the Lansing Engineers Club and the Michigan State College Faculty Club. The professor is also a member of the Michigan Engineering Society, the Engineering Society of Detroit, director of the Lansing Branch of the Michigan Auto Club, and chairman of the East Lansing Board of Appeals.

Prof. Cory was eligible for retirement in 1948 but was persuaded to remain on active duty as a full professor in order to assist with the heavy teaching load and with the organization of the expansion program required by the occupation of the new Electrical Engineering Building. Incidentally, he contributed a great deal toward the realization of the new building and is pleased that he could spend one year in it after 36 years in Room 13, Olds Hall.

Prof. Cory is a firm believer in the objectives and ideals of Michigan State College under the present leadership and believes it will continually gain in stature. M.S.C. he says reminds him of his old school, the University of New Hampshire, where the same wholesome democratic spirit exists between students and faculty. Hundreds of his former students will agree that he has helped set this course and, in addition, has always been a fair, able and conscientious teacher.

Professor Foltz

As any of his former classes will testify Prof. Foltz has always stressed the importance of principles in engineering. What they may not know, unless they entered into a private conversation with him, is that his examination of and reliance upon principles has caused him to be a keen inquirer of philosophical questions. Before he realizes it, a student in conversation with Prof Foltz is sincerely counsidering and voicing an opinion on the trends of ethics in modern

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SOIL SCIENCE

BILL SAIA, Ag.E. Sr.
HANK DARLINGTON, Phy. Sr.

AGRICULTURE OFFERS MANY COMPLEX PROBLEMS for the engineer. One of the most common, and at the same time complex of these problems, is one of whose existance very few are aware. This is the disposition of the rain and snow that fall on the earth. Attempts have been made at various times and places to follow rainfall from the time of its reception from the atmosphere, through the earth, and back to the atmosphere, but never on the scale and to the degree of refinement as followed here at Michigan State. The Michigan Agricultural Experiment Station in cooperation with the Soil Conservation Service of the United States Department of Agriculture has one of the most elaborate hydrologic research stations in the world. Here, hydrology, that "science treating of water," is studied in conjunction with the program of research in soil and water conservation.

Field Installations

The field installations for this study are located in three *natural watersheds*, or small valleys. These watersheds have very similar characteristics including slope, direction of slope, area, soil type, and general configuration. One watershed has as cover an oak-hickory stand of hardwood. The other two watersheds are cultivated similar to cultivation practices in common use in Michigan. Thus, three major types of cover, which are very similar to those found throughout the state, are primary basises of comparison between these watersheds. Cultivated watersheds "A" and "B" lie side by side on the college farm just south of WKAR's new transmitting station. They are 1.4 and 1.9 acres in extent, respectively. The wooded watershed is located at Rose Lake Wild Life Experiment Station, ten miles northeast of Lansing, and consists of 1.6 acres.

Complex Recording Instruments

Seldom outside of large, precisely controlled industrial installations does one find such a complete aray of accurate recording instruments as are ultilized in this project. At the cultivated watersheds as many of the instruments as possible are located in a small building between the two watersheds. Many of these instruments record information from relatively distant points, by remote control. Among the unusual instruments to be found here is a pyrheliometer. This device measures the intensity of solar radiation or energy received from the sun. Essentially, it consists of a small thermopile enclosed in an evacuated glass bulb and mounted on the roof of the building. The thermopile element, which consist of concentric black and white rings, converts the sun's rays into electric energy by utilization of the Seebeck effect. The voltage output of the thermopile is directly proportional to the solar radiation. Thus, a properly calibrated voltage-measuring device would give a direct reading of the solar intensity. The measuring device utilized in this installation is a Leeds & Northrup Micromax, automatic recording potentiometer. This instrument makes a direct plot of solar intensity with respect to time.

Soil Temperature Recorder

Another instrument located in this building is an automatic soil temperature recorder. This instrument makes a continuous record of temperature at each of sixteen resistors. These resistors are distributed one in the air and fifteen at different levels in the ground down to 33 inches. The resistance of these resistors is effected by the temperature, and each is connected through a stepping relay to a Wheatstone bridge which in turn is recorded by another Micromax recorder. The stepping relay selects resistor elements at approximately 50-second intervals, and the temperature of this resistor is recorded by the recorder before the next resistor is selected. One of the fifteen

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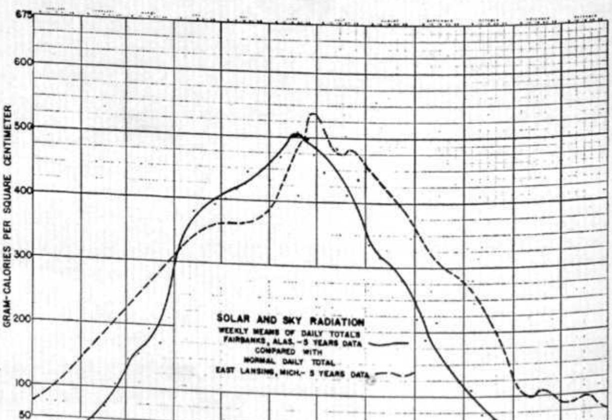

Figure 1.—Solar and Sky Radiation.

ONCE UPON A MOON

SAM BERBERIAN, Math Grad

RAY BIGGETT AND I have been friends for as long as I can remember. We played together when we were kids, until we were old enough to fight; and then we fought together. I guess Ray and I have so much in common, we could write each other's biographies without doing very much research. But when Ray came to me with this story, this incredible account of an impossible experience . . . I think I must have hurt Ray's feelings. I say this, because I want you to know that the first time I heard it, I didn't believe it anymore than you will when you read it; but after you live with it for a while . . .

Ray Biggett is an instructor in the Electrical Engineering department of our school; Ray made a machine. He's always been a truly capable student—the sort of fellow who sits in the first row, and gets whispered about in the last row—so it's not unusual that Ray made a machine. But the machine Ray made *was* unusual. You see, Ray made a study of analog machines . . . gadgets which solve general physical problems by converting them to analagous electrical circuits. For example, in a mechanical problem, the mass parameter is represented by an inductance, elasticity by capacitance, and friction losses by resistance. The method is compact, relatively cheap, and the results are tolerably accurate. This is the kind of machine Ray built, but he built it with a twist. In no previous machine had there been a provision for introducing time as a lumped parameter; time was simply introduced at random, entirely different from the manner in which other parameters were applied. Ray felt this was an oversight, and set about devising a method by which the time factor could be controlled as explicitly as the other dimensions of the problem. He succeeded, by means of a fantastically intricate circuit which makes moon radar look like a pocket flashlight. He built it, not haphazardly, but following careful analytical methods requiring subtle, relativistic mathematics. When his machine was completed, Ray could predict the nature of every response that it could possibly make to a physical problem. So, he fed his machine a test problem,—that of a freely falling object under the influence of gravity. After all the proper connections had been made, Ray switched the lights off in order to see the response on the monitor scope more clearly, and turned on the main power switch to the equipment.

Ray's laboratory is on the sixth, and top floor of the Electrical Engineering building, in fact, it is the only laboratory on that floor. At 9:30 in the evening, the building is decidedly deserted from the fourth floor up. At 5 o'clock the next morning, the day janitor opened the main entrances, switched on the hall lights, and began making his routine inspection of the lavatories. As he reached the stairway to the fifth floor, he noticed a peculiar blue haze beyond the turn of the bannister; suspecting a fire, he ran up the steps to investigate.

At approximately 6:15, it was discovered that the top two floors of the Electrical Engineering building had vanished . . . absolutely, and inexplicably vanished! At 6:20, when the body of the day janitor was discovered lying at the bottom of the stairway to the fifth floor, he was still frozen from the waist up, his eyes and flesh peculiarly cracked, as if he had been pushed into a refrigerator as cold as the space between galaxies. . . . It was suspected that the blue haze at the turn of the stairs was in some way responsible for the ghastly accident, and the stairway was promptly roped off. At 7:00, the building superintendent received a call from the engineer on duty at the power generating plant, who reported that his recording apparatus indicated a decidedly abnormal drain of current, which had been traced to the electrical engineering building. A check of the meters in the main electric control room definitely identified the source of the power drain as being the fifth and sixth floors of the Electrical Engineering building! There had been such a tremendous surge of power at one instant, that all switches and breakers in the circuit had been welded shut, and it was decided that the equipment be left untouched until a thorough investigation could be made of the entire macabre affair.

Ray's disappearance was noticed at 9:00, when he failed to show up for his first class. At the end of the third day, Ray had run up a hell of a light bill!

His resurrection occurred precisely at 11:30 A.M. of the fourth day, and simultaneously, the Electrical Engineering building regained the dignity of its top two floors, and the abnormal power drain ceased.

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METAL—INSIDE OUT

SHELDON T. SMITH, Met.E. '48

DID YOU EVER LOOK CLOSELY at a piece of metal? Yes, it's hard, it's probably shiny, it just looks . . . well . . . metallic! To the average person this is enough to see. In order to understand more fully what there is to be seen we must consult the man who brought this hard, shiny substance into the world, the metallurgist. Let us look at this piece of metal over the shoulder of our new helper.

First our metallurgist friend prepares a specimen. This preparation starts with the choice of the most significant section or area of the metal to be examined. By means of a hacksaw or abrasive cut-off wheel this portion is removed from the sample. At all times extreme care is taken to prevent heating the metal at the cut surface because such heating might cause internal changes. The surface is moothed by grinding with a series of increasingly fine abrasive papers followed by a final polish, usually on a soft cloth with either levigated alumina, rouge, or some other equally fine finishing powder. Our surface, as a result of careful work, is now sufficiently smooth, flat, and free from scratches so that it is truly representative of the chemical and physical condition of the metal. Observation of this polished surface by eye or by means of a microscope reveals little more than a bright mirror-like surface.

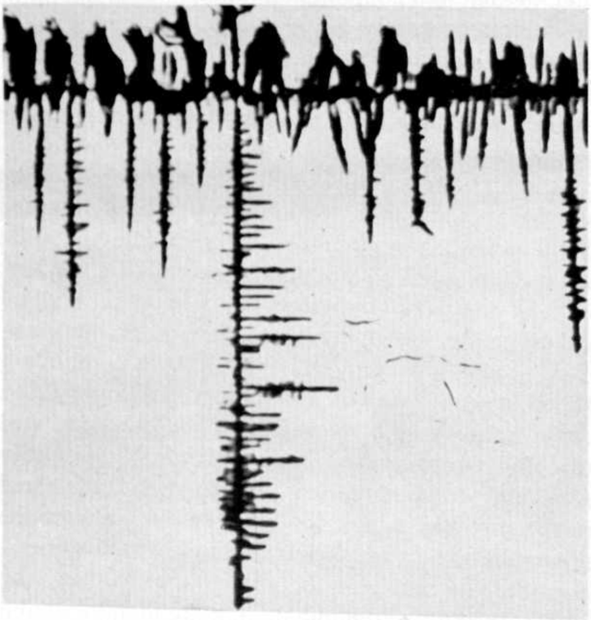


Figure 1.—Typical dendritic pattern formed of pure lead. Magnification about 200 diameters.

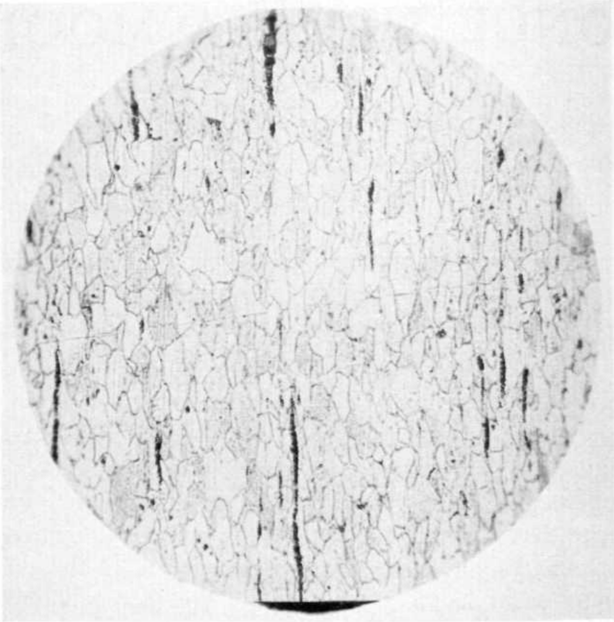


Figure 2.—Photomicrograph of cast brass illustrating the intersection of dendrites to form grains. Magnified about 100 diameters.

Next the metallurgist etches this nicely polished surface. Etching is merely the process of revealing structural details of the metal by the preferential attack of a chemical reagent. The choice of the reagent, therefore, depends upon the chemical and physical condition of the metal and the degree of contrast that is needed for emphasis. Typical of the many etching reagents are such things as two percent nitric acid in ethyl alcohol, ten percent sodium hydroxide solution, and five percent oxalic acid solution. Usually the polished metal surface is in contact with the etching reagent for only a short time, perhaps a few seconds.

With the aid of a modified type of compound microscope our metallurgist now examines the etched surface and finds that a great change in the appearance of the surface has occurred. By means of photography it is possible to make an accurate and permanent record of what the eye sees. Such a picture, called a photomicrograph, is taken through the microscope and clearly reveals details and fineness of microstructure that are much too small to see with the unaided eye. This science, which correlates the microstructure of metals and alloys with engineering properties, is called metallography.

In the particular case of a pure metal it is possible to see the large grains that make up the surface and interior of the specimen. At the beginning of solidification of a molten metal around certain tiny nuclei, the atoms of the metal take on a specific geometric arrangement. This pattern is called a space lattice and is frequently based on the cubic system. Although at first there are only a few atoms arranged in this basic manner, there is a tendency as crystallization continues for more rapid growth in some directions than in others. Since this crystallization occurs in three dimensions along mutually perpendicular axes, the result is a "pine-tree" pattern that the metallurgist calls dendritic. A typical dendrite is shown in Figure 1.

As these dendrites continue to grow and expand they eventually will run into each other forming grain boundaries. Figure 2 shows these intersections. The size and number of grains depends upon the number of nuclei present in the molten metal. If there are many such nucleation centers the crystals will be unable to expand very far and the result will be the formation of many small-sized grains. On the other hand, few nuclei will result in a small number of relatively large grains. Thus each grain may be oriented differently from its neighbor. This helps to explain the difference in the rate of chemical attack which shows up in the photomicrograph in Figure 3 as light and dark grains.

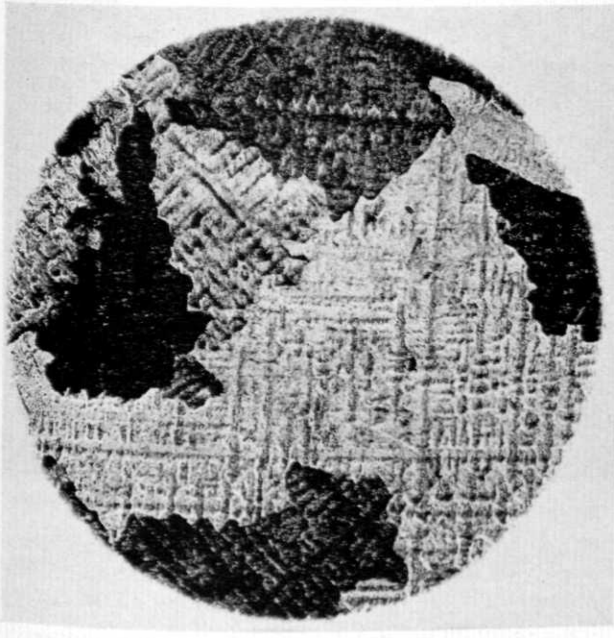


Figure 3.—Microstructure at about 100 diameters of a tiny area of one of the threads of a common wood screw.

Consideration of these grains reveals many strange occurrences. Figure 4 shows the phenomenon known as grain growth. Ordinarily this does not occur during the reheating of cast metals which have not been cold worked after casting, except in ferrous materials which recrystallize during heating through the transformation range. Also in certain heat treating operations performed on steel, it may be desired to cause diffusion without the possible grain growth that is likely to occur under these conditions. Realizing all this, the importance of the metallographic approach

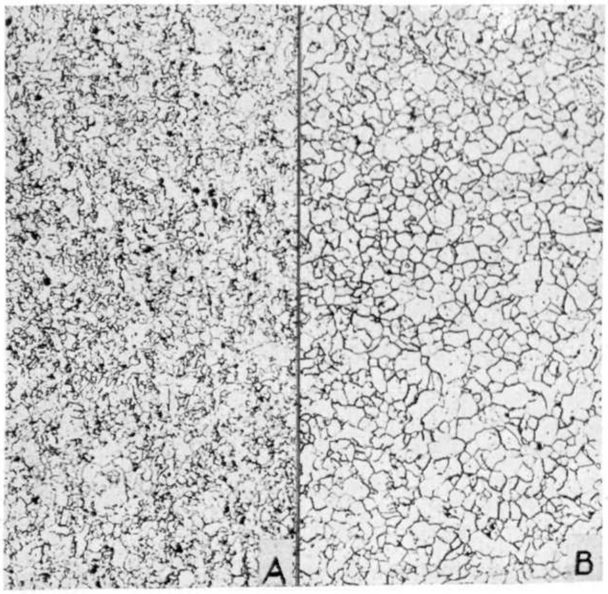


Figure 4.—Photomicrograph at about 100 diameters showing an increasing grain size in the same sample of pure iron following proper heat treatment.

is evident. We didn't even see these grains when we first glanced at our specimen—remember?

In order to show a further definite application of metallographic technique let us now examine a common wood screw. By means of a macrograph of an unetched longitudinal section we can obtain a clear over-all picture of the sample at a low magnification of about 5 diameters as shown in Figure 5. After etching, a tiny section of one of the threads, when magnified some 100 times under the microscope, will be revealed as in Figure 3. Because good machinability is essential in screw stock the question arises as to why this particular metal can be machined easily. Perhaps the greatest single factor readily observable is the presence throughout the microstructure of a number of non-metallic inclusions. It has been found that sulfides, particularly manganese sulfide, have a definitely beneficial effect upon cutting qualities. Of course there are many other things to be considered when machining screw stock. In fact,

Continued on page 38

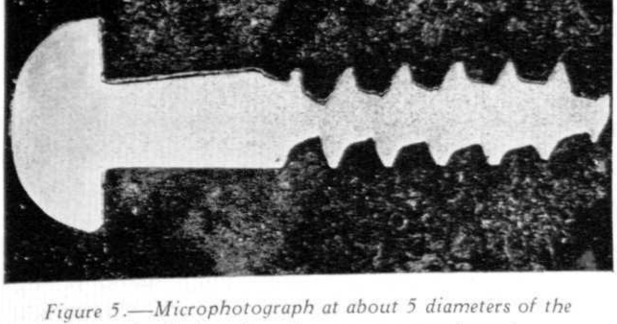
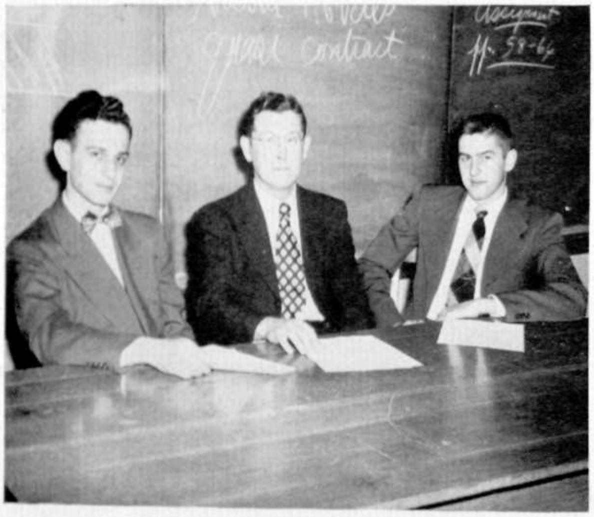


Figure 5.—Microphotograph at about 5 diameters of the longitudinal section of a common wood screw.

THE SOCIETIES

Pi Mu Epsilon

At a recent meeting of PM's, Dr. B. M. Stewart gave a talk on the right triangles inscribed in conic sections. The new officers as listed in the photograph were introduced to the society at this meeting.



Pi Mu Epsilon Math Honorary Officers

Left to right: Edward J. Seligman, President; Dr. John Hill, Faculty Advisor; Bernard Yemc, Treasurer. Officers not present: Stanley Hoskins, Vice-President, and Terence DeBlock, Secretary.

Sometime in May Theodore R. Reiff, Sr. Math major from New York, will present a talk on "Dimensional Analysis." In addition, the society wishes to announce that Math Colloquims are held every Tuesday afternoon in room 105 Morrill Hall beginning at 3:00 P.M. Faculty members present talks on particular problems, fields, and application of Mathematics.

American Society of Agriculture Engineers

The recent election of this new slate of officers found the student branch of the ASAE's, a progressive and greatly expanded organization due to the untiring efforts of the previous officers. The club membership has kept abreast of the increasing size of the Agricultural Engineering Department and boasts a membership of better than 50% of those enrolled.

Representatives from industry engaged in production and related to fields of Agricultural Engineering, including machinery, farm buildings, drainage, and chemistry, have been guests at the regular meetings.

The finest report to the Farm Equipment Institute was turned in this spring. This report includes all activities of the club members and the club.

The biggest project of the Ag.E.'s this year has been the ASAE Student Journal. It contains articles in the field of Ag.E. from schools in the U. S. and Canada. The journal is published by the school that is host for the national meeting of the Parent Society of the ASAE. That meeting will be held at M.S.C. this year and at that time the journal will be distributed to all the student branches of the ASAE attending the meeting June 18-23. Much credit for the publication of the journal should go to Editor Glenn Peterson, Assistant Editor Henry Hase and to the staff. The club will be host to all the members of the student branches attending the convention here in June.

A. S. A. E.

Back row, left to right: Don Schurr, Engineering Council Representative; Winton Hath, Treasurer; Jack Hansen, Scribe.
Front row, left to right: Carl Libby, secretary; Allen Gillette, President; Norman Greziak, Vice-President.

The current activities of the club is the preparation of the Ag.E. equipment and demonstrations for the Engineering Exposition and Engineering Field Day.

American Institute of Chemical Engineers

Otto Hall, in charge of the Engineering and Architecture Section of the State Department of Conservation, spoke to the Chem. E.'s meeting March 2, on the profession of engineering. Mr. Hall outlined the history of registration for engineers, and clarified Michigan laws pertaining to registration.

Continued on page 38

HEALTH PHYSICS

BY JOHN R. GREGOR, Ch.E. SR.

Health physics, the new branch of radiology devoted to the protection of personnel, is still in the experimental and evolution stage. However, it already has a remarkable service record which has been achieved through continuous vigilance and careful coordination of analysis and control.

THE DEVELOPMENT OF ATOMIC ENERGY into peacetime applications has introduced many problems. One that is of major importance is the effect of radiation particles upon the human body. In order to understand this problem more fully a new branch of radiology has been conceived by the Atomic Energy Commission . . . health physics. The purpose of this group is not only to detect and evaluate radiation hazards encountered in the laboratories, but they must also be aware of the presence of dangerous radioactive waste materials which are a result of the research being done. Because active waste material, both liquid and solid, cannot be discarded in the normal manner, considerable effort is necessary to prevent its accidental disposal to city sewers, public waterways, and general public disposal systems. Furthermore, the control of radioactive gases and airborne particles must be rigidly maintained to prevent their inadvertant travel to other parts of the laboratory or to the outside atmosphere. Thus, the responsibility of the health physics groups extends not only throughout the laboratory but to the surrounding community as well.

Units of Measurement

As in all fields of science involving measurements, health physicists employ units designed to measure the amount of radiant energy absorbed per unit volume of matter. Basic among these units is the roentgen. This unit has been defined as the amount of X, or gamma radiation whose emission per .0013 grams of air produces, in the air, ions carrying a charge of one electrostatic unit of either sign.

Concurrent with this unit (which is designed for air only) are the rep, which is that dose of any ionizing radiation which produces an energy absorption of 83 ergs per cubic centimeter per tissue, and the rem, that dose of any radiation producing a biological effect in man equivalent to that produced by one roentgen of gamma radiation.

In 1936, the American Advisory Committee on X-ray and radium protection adopted a daily exposure limit of one hundred milliroentgens per day. This limit has been used almost completely throughout atomic project sites.

Effects on Tissues

Now let us consider some of the possible effects of exposure to radiation and a few of the possible results of overexposure.

Because most biological tissues contain large quantities of water and may even be considered as dilute solutions of organic and inorganic material, the changes that take place in water following exposure to radiation should be considered. The ionization of the water molecule results in the ejection of an electron with splitting of the molecules into a hydrogen ion and a hydroxyl radical . . . thus: $H_2O \longrightarrow H^+ + OH^-$. In addition, the production of some H_2 and O_2 gases leads to the production of H_2O_2. The oxidation of inorganic ions by OH radicals or their reduction by H ions explain most of the reactions which have been observed in this connection.

Effect on the Skin

The skin consists essentially of two layers—the epidermis and the dermis. The epidermis is the horny layer forming a protective cover, whereas the dermis contains blood vessels, nerve cells, and hair follicles.

Penetrating radiation will produce changes in the dermis resulting in irritation, damage, or destruction to the vital cells of the skin. If excessive, exposure can result in ulcerations leading to cancer.

Constant exposure to radiation has been known to effect the blood stream also. It appears in the form of a lowering or a complete loss of the white blood cells from the peripheral blood. For this reason, blood counts on all laboratory technicians are taken at frequent intervals.

The changes resulting from damage to genes are generally spoken of as mutations, and the majority of them are harmful. Because of this, every precaution is taken to prevent the occurrence of this process. Until more is known about the process strict adherence to radiation exposure limits is about the only protection available.

The science of health physics is by no means completely covered in this article, which is intended only to acquaint the reader with some of the problems involved in the Atomic Research program. The field of health physics is new, rapidly developing, and very important. Moreover, this new field has infinite possibilities for expansion just as the whole science of Atomic Energy.

ST. PATRICK WAS AN ENGINEER

PROFESSOR L. C. PRICE

IN THE SPRING a young man's fancy often turns to thoughts of love, but if the young man is an engineering student his thoughts also turn to the universal benefactor of all engineers, whose birthday occurs on the seventeenth of March.

For Saint Patrick was an engineer. He was the original engineer, and any engineering student with a spark of gratitude in his breast must of necessity pause in his work to do honor to his patron saint. The fact that Saint Patrick really was an engineer has been attested to by engineering students so universally and for so long a time that there can be no doubt about it. It is not even open to question.

Because, even if I were such a heretic as to disbelieve all the evidence, I have seen him with my own eyes. I have not only seen him, but he graciously tapped me on the shoulder and knighted me while I kneeled and Kissed the Blarny Stone. The original Blarny Stone, I mean, which he brought all the way from Ireland just for that occasion. Of that also, there can be no shadow of doubt.

It seems well at this time to enlighten those few among us who may be unaware of the facts in the case, and to set them right as to some of the things which are done by some engineers in their efforts to honor their Founder.

The University of Missouri and a number of other midwestern universities have such celebrations in the late Winter or Spring, but my broadest experience with them was from 1926 to 1942 at the University of Arkansas. There the thing varied a little from year to year, always getting a little better, and always graced by the attendance of St. Patrick himself with his Queen and attendants.

There was a time when The Day was ushered in at midnight by explosions of dynamite, the louder the better. There must be nothing sissy about anything the engineers did. That was a night when Dean Gladson did not sleep very well. The dynamite may not have kept him awake but telephone calls from the neighbors did. The dean's answer was always the same: "How do you know it was done by the engineering students?" Of course there was no answer to that one because nobody ever saw anybody actually do any shooting. But if the Dean was noncommital when answering the neighbors, he was very much to the point when laying down the law to the students afterwards. The result was that finally some genius thought up the idea of having fireworks instead of dynamite, and having it about ten o'clock instead of midnight. Thereafter the neighbors and the Dean slept better and the whole affair took on a more respectable and wholesome aspect and the public came over wholeheartedly to our side.

The Day was always a Friday. In the later years, however, it really began with an All-Engineers banquet the night before, in an atmosphere of jollity and good will, at which Sain Patrick and the Dean were toasted, faculty take-offs were nearly always good-natured, and the speech of the evening was mostly a matter of being told how good and important engineers are; all in strict truth, of course.

After the banquet came the fireworks exhibit, with bombs, pinwheels and all the rest, and nearly always an arrangement on a frame, which, when lighted, spelled Engineers. There was no further activity that night. No organized activity, that is.

Engineers Day itself was always a holiday for all engineering students. It was the Big Day, with an engineering convocation in the morning which was a serious affair, with always a speech by some outstanding engineering alumnus, and the first appearance of St. Patrick and his Queen and attendants. The Saint and Queen entered the auditorium just before time to begin the program, marched down the isle, and sat on the stage with armed guards on each side while the address was being delivered. After that, while the Seniors knelt and kissed the Blarny Stone (THE Blarny Stone, that is), the Saint tapped each one on the shoulder and dubbed him Knight of Saint Patrick. These ceremonies generally lasted until noon. By that time the Engineers Day Edition of the College paper was on the campus.

The paper that day was always printed on green paper in honor of Saint Patrick. It divulged for the first time the identity of St. Patrick's Queen and his attendants, contained the names of all senior engineers, and items of interest about as many of them as possible.

The afternoon of The Day was given over to Engineers Day exhibits. With students in charge, every piece of apparatus in all the laboratories was running, besides models, tricks, and any other ex-

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FIRST ANNUAL

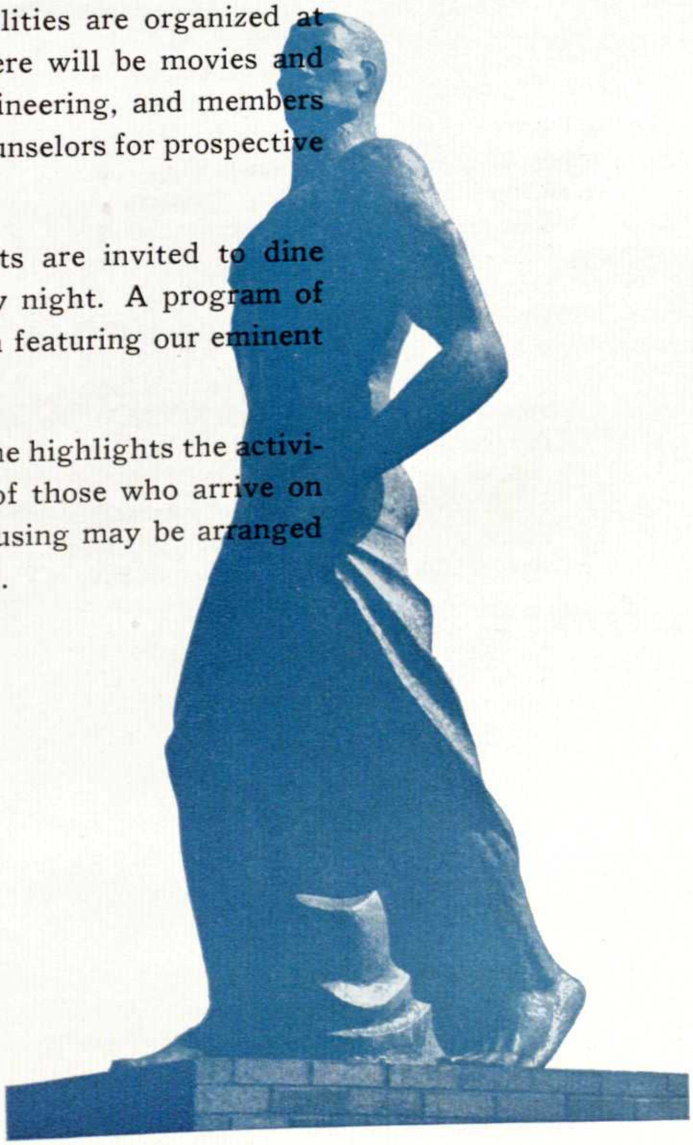
ENGINEERING EXPOSITION

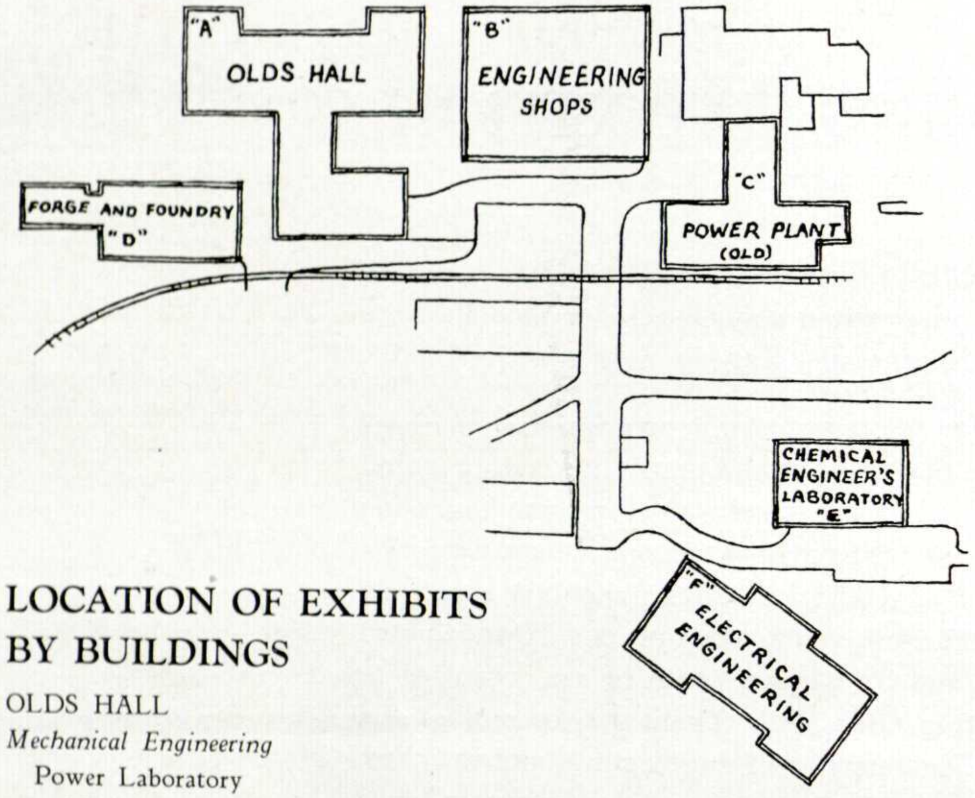
Last fall we heard a rumor, which by winter had been confirmed, and now, after these many weeks of planning, the First Annual M.S.C. Engineering Exposition is a reality.

This first year the exposition is appropriately marking the dedication of the new Electrical Engineering building, and engineering displays and activities are staged in commemoration of this event. All laboratories are open for continuous inspection and each department of the engineering school is especially devoted to the entertainment and interest of its visitors. Guided tours of the campus and its various facilities are organized at the registration room in Olds Hall. There will be movies and lectures covering various aspects of engineering, and members of the faculty will be available to act as counselors for prospective students.

All visiting high school students are invited to dine as a group in the Union Cafeteria Friday night. A program of short speeches is planned for the occasion featuring our eminent Dean Miller and Professor C. L. Allen.

The 1949 intra-squad football game highlights the activities of Saturday afternoon, and for any of those who arrive on Friday and wish to stay over, campus housing may be arranged for at the registration desk in Olds Hall.





LOCATION OF EXHIBITS BY BUILDINGS

OLDS HALL

Mechanical Engineering

Power Laboratory

Machines in operation:

1. Large 120 H.P. Nordberg steam engine. The cylinder of this machine is 12″ by 30″. It is double acting, developing normal horse power at 120 R.P.M. Operating steam pressure is 100 pounds per square inch.
2. Steam driven two stage Sullivan air compressor unit. Operating at 130 R.P.M., this compressor will furnish 180 cu. feet/min. of cooled air.
3. Single cylinder, two cycle Fairbanks-Morse diesel engine. Normal operating speed is 300 R.P.M., developing 40 H.P.

Machines on display:

1. 25 KW Cummins diesel motor-generator unit.
2. International Harvester "Ready Power" motor generator unit.
3. LeRoy gasoline motor generator unit.
4. Torry Turbo generator.
5. Russell steam engine.

Miscellaneous displays:

1. Various gauges and instruments used in testing these machines.
2. Student built air compressor with cut-away models
3. Refrigeration unit.
4. Industrial management exhibit.
5. Materials testing laboratory display.

Don't miss the magic ball!

INDUSTRIAL ENGINEERING EXHIBITS

Located in front of Power Laboratory

1. Scale model of Olds Hall of Engineering and immediate surrounding area, including Stores building. Maintenance shops, Power Plant, Woodshop, Forge building, and Wells Hall.
2. Model of Power Laboratory.
3. Cutaway model of the Foundry.
4. Scale model of Machine Shop. Machines and equipment all to scale. Models of this type used to assist in plant layout—either laying out a new plant or changing an existing plant.
5. Kymograph—an instrument used in motion study research. Will measure time in 100,000ths of a minute.

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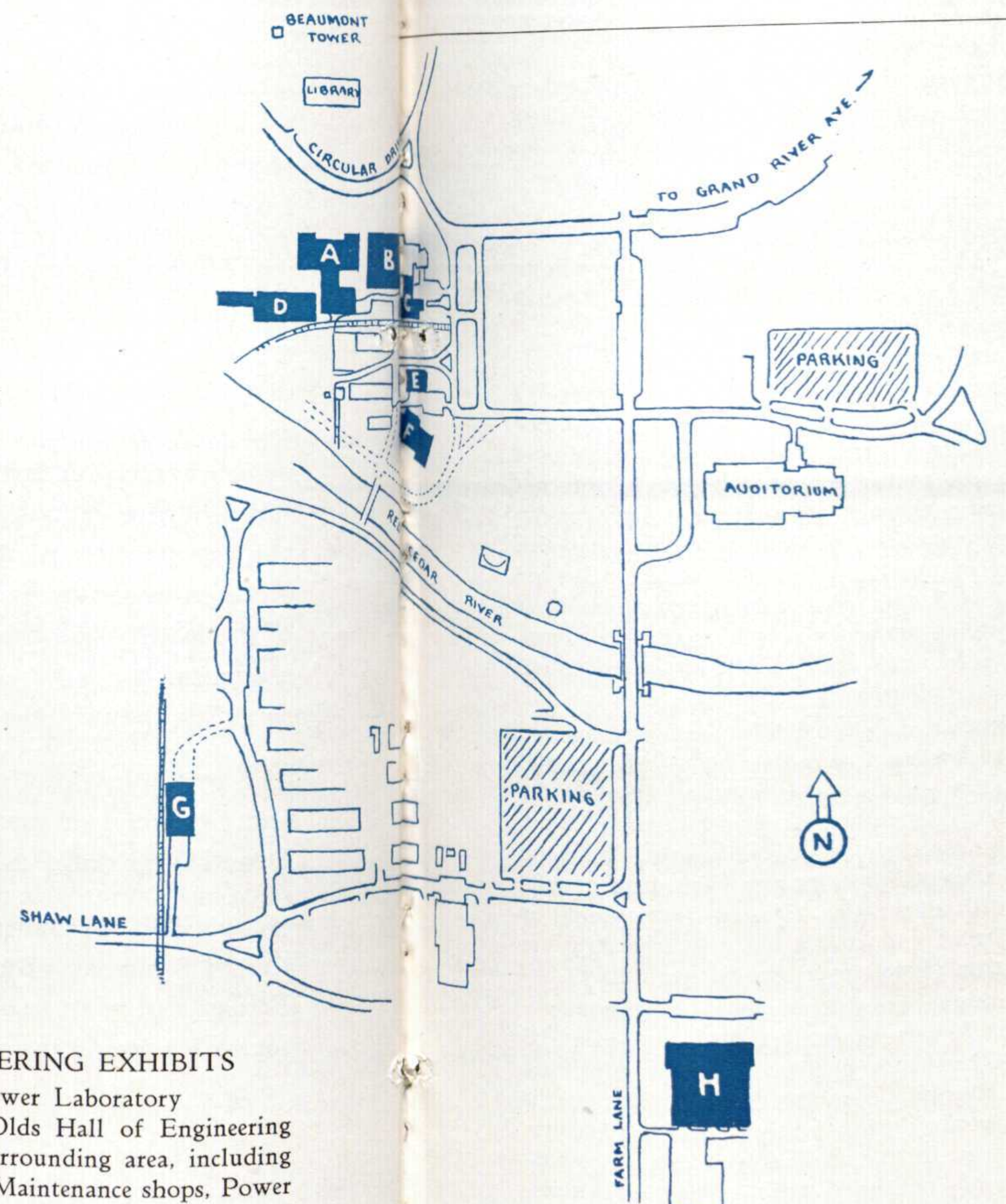
THE FIRST ANNUAL MICHIGAN STATE COLLEGE ENGINEERING CONVENTION



Program of Events

FRIDAY, MAY 13

1:00, 5:00, 7:10-10 P.M.

Registration—Olds Hall

Tours of Laboratories, Exhibits, Demonstrations:

Olds Hall, Ag'r. Engineering, Electrical Engineering Building

Wood Shop, Power Plant, Electric Generating Room, Forge Shop, Chemical Engineering Building, Foundry, Machine Shop.

Continuous Movies, Olds Hall and Auditorium

"Prospecting for Petroleum"
"Freedom Rides on Rubber"
"High Pressure Die Casting"
"The Building of a Tire"
"The Micro TIMER"
"Science Spins a Yarn"

FRIDAY, 6:45 P.M.

Informal Dinner, Union Cafeteria—everyone welcome

"Welcome," by Dean of Engineering, Lorin G. Miller

Speech by Prof. C. L. Allen

SATURDAY, MAY 14

9:00-12:00 A.M.

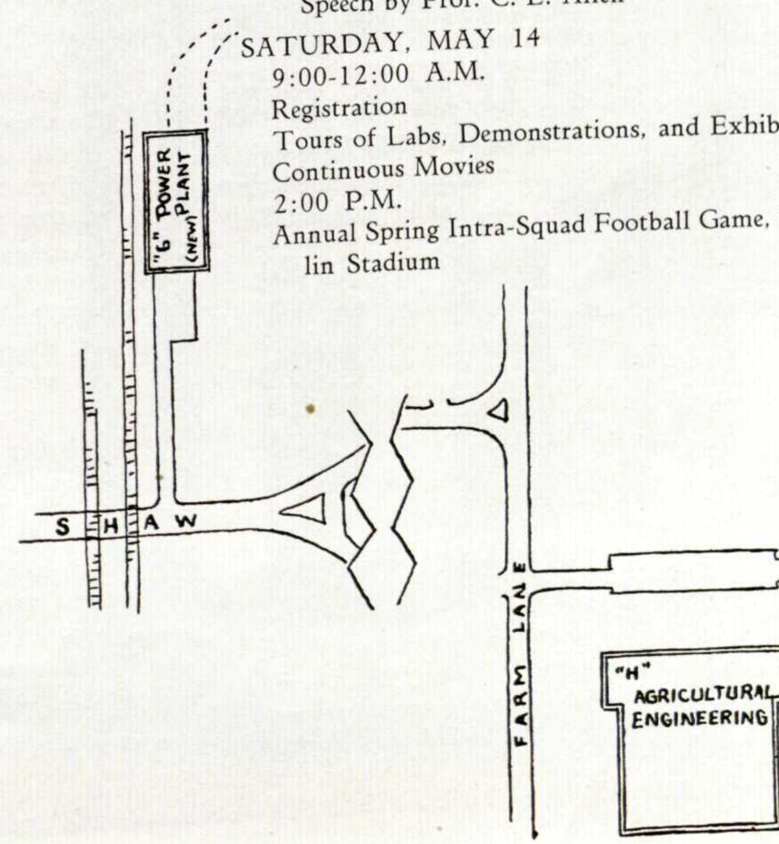
Registration

Tours of Labs, Demonstrations, and Exhibits

Continuous Movies

2:00 P.M.

Annual Spring Intra-Squad Football Game, Macklin Stadium



EXHIBITS

Continued from page 20

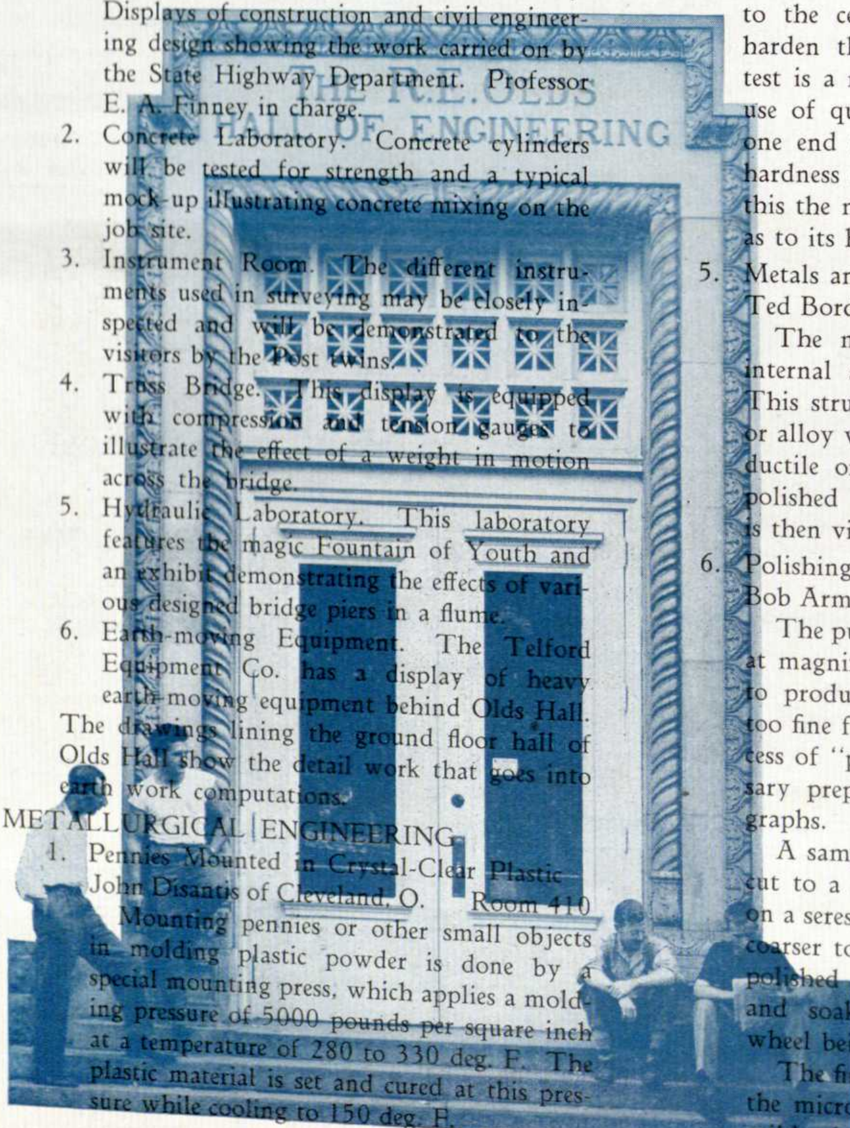
6. Practo-chron—used to assist in teaching of stop-watch reading and techniques. Instrument is automatically controlled, and automatically records data. Used in time study training.
7. Diagramatic chart of most efficient work area. Used in time and motion study classes.
8. Model of Abrasive Tumbler. Used to clean and polish small items. Especially adopted to small brass and metal jewelry, and small plastic novelties.
9. Miscellaneous equipment used in Industrial Engineering courses, time study, plant layout materials handling, motion study, production control, etc.

All material made by students to be located in front portion of Power Laboratory.

CIVIL ENGINEERING

1. State Highway Experimental Laboratory. Displays of construction and civil engineering design showing the work carried on by the State Highway Department. Professor E. A. Finney in charge.
2. Concrete Laboratory. Concrete cylinders will be tested for strength and a typical mock-up illustrating concrete mixing on the job site.
3. Instrument Room. The different instruments used in surveying may be closely inspected and will be demonstrated to the visitors by the Post twins.
4. Truss Bridge. This display is equipped with compression and tension gauges to illustrate the effect of a weight in motion across the bridge.
5. Hydraulic Laboratory. This laboratory features the magic Fountain of Youth and an exhibit demonstrating the effects of various designed bridge piers in a flume.
6. Earth-moving Equipment. The Telford Equipment Co. has a display of heavy earth-moving equipment behind Olds Hall.

The drawings lining the ground floor hall of Olds Hall show the detail work that goes into earth work computations.



METALLURGICAL ENGINEERING

1. Pennies Mounted in Crystal-Clear Plastic
John Disantis of Cleveland, O. Room 410
Mounting pennies or other small objects in molding plastic powder is done by a special mounting press, which applies a molding pressure of 5000 pounds per square inch at a temperature of 280 to 330 deg. F. The plastic material is set and cured at this pressure while cooling to 150 deg. F.

2. Quenching of Steels and Testing Their Hardness
Jim Bruner, Lansing Room 412
Quenching is a form of heat treatment of steel whose purpose is the obtaining of great hardness. A steel is heated to an elevated temperature and is then cooled rapidly by placing the heated metal in a liquid. The hardness of the steel is then determined by use of a Brinell or a Rockwell hardness tester. Hardness of steel will increase as the cooling rate is increased.

3. Automatic Temperature Controllers
Herb Lloyd, Grand Rapids Room 412
These instruments are used to indicate, record, and control the temperature of metallurgical furnaces.

4. Jominy Hardenability Test
David Pierce, Buchanan Room 412
It is important to the metallurgist to know whether a part he is hardening will be hard to the center or not. All steels will not harden through in all sizes. The Jominy test is a means of evaluating this. It makes use of quenching a heated standard bar on one end and, after cooling measurement of hardness along the length of the bar. From this the metallurgist makes his interpretation as to its hardening potential.

5. Metals and Alloys Under the Microscope
Ted Borden, Chicago Room 410
The microscope is used to examine the internal structure of a metal or an alloy. This structure determines whether the metal or alloy will be strong or weak, hard or soft, ductile or brittle. After a metal sample is polished and etched properly, the structure is then viewed under the microscope.

6. Polishing and Etching of Metal Samples
Bob Armstrong, Battle Creek Room 410
The purpose of photomicrographs, pictures at magnifications from 50 to 2000 times, is to produce permanent records of structures too fine for the unaided eye to see. The process of "polishing" and "etching" is a necessary preparation for successful photomicrographs.

A sample of the material to be polished is cut to a convenient size and then smoothed on a seres of fine abrasive papers passing from coarser to finer paper. The specimen is then polished on wheels covered by special cloth and soaked with abrasive solutions, each wheel being treated with a finer solution.

The final process before examination under the microscope is to etch the sample with a mild solution of inorganic acid so as to bring out the grain structure of the metal specimen.

7. Principles of Photography
Jay Fowler, Cambridge, Wis. Room 410
Photography provides a means of obtaining a permanent record of something observed. It combines both physical and chemical processes. It is a physical process in that light is gathered from the object being photographed and recombined to form an accurate image of that object. Chemistry plays the part of converting this light energy into a permanent record.

8. Optical Pyrometers
John Richards, Lansing Room 412
An optical pyrometer is a small, portable instrument for measuring the temperature of red hot bodies. The instrument operates by comparing the color of the heated body to the color of a small heated resistance wire located in the lens of the instrument. This comparison is performed visually. The operator adjusts the current flowing through the wire until its color matches that of the body; a direct reading scale then gives the temperature of the body on which the instrument is sighted.

9. Macroetching and Examination
Jim Corey, Lansing Room 410
Macro examination is a convenient method for detecting any dangerous and undesirable non-uniformities in a metal or alloy, resulting from its chemical composition or mechanical working it received. It consists of obtaining a suitable, representative sample of the metal polishing it roughly and etching (corroding the surface) heavily with an acid, followed by the visual examination of the piece. Any defects appear greatly magnified as cavities or cracks and may be readily detected.

10. The Metallurgical Camera
Don Alverson, Jackson Room 410
One of the main purposes of a camera in the field of metallurgy is to record the internal structure of metals and alloys. This microstructure plays an important part in the study of metals and it is desirable to have a record of them, where many different metals and alloys are handled.

The metallurgical camera, called a metallograph, consists of three distinct parts, a microscope, an ordinary bellows camera, and a special lighting system. The microscope, which is really the heart of the system, functions in two ways. It directs light on to the specimen and then magnifies the returning light. Since light is necessary for photography, the metallograph provides a powerful lighting system. Light from the lamphouse is directed through the microscope and on to the surface of the specimen. This light will either be absorbed or reflected depending upon the condition of the surface of the specimen. The light that is reflected back from the specimen passes through the optical system of the microscope and the image is recorded by the camera. Different magnifications are possible by using various lenses in the microscope and by adjustment of the bellows on the camera. The maximum magnification is roughly two thousand diameters.

FORGE AND FOUNDRY

Mechanical Engineering

1. Forge laboratory will be operated by students Friday afternoon and Saturday morning. Exhibitions of hand forging, gas welding, arc welding, and flame cutting will be demonstrated.
2. Heat Treat Laboratory. Gas and electrical heat treating equipment is displayed. Friday afternoon students will be heat treating steel and preparing specimens for physical testing.
3. Physical Testing Laboratory. Brinell and Rockwell Lardner testing machines will be used in taking hardness readings; an important physical test for metals.
4. Chemical Laboratory. A display of equipment for chemical analysis of metals and alloys. This laboratory is used for research.
5. Foundry Laboratory. Students will be casting pistons for air compressor in permanent molds. There will be a limited supply of souvenior castings. Also to be seen are a 24-inch cupola, a Detroit electric arc furnace, and two gas-fired crucible furnaces for non-ferrous melting.
6. Sand Test Laboratory. Equipment for testing foundry molding and core sand.

MACHINE SHOP

Mechanical Engineering

The machine shop, under the supervision of Professor Vanderslice, is mainly devoted to the production of air compressors. Classes will meet here Friday 3-6 and 6:30-9:30; Saturday 8-11 A.M.

1. Air compressors are made in the M.S.C. machine shop, now converted to factory production and methods. All operations of turning, milling, and grinding are carried on by students. Junior class members of the group act as supervisors and coordinate the work of the sophomores. The juniors also act in a capacity as inspectors in final and sub-assembly.
2. Parts of unassembled compressors will be placed on tables near the aisles spectators will use. Visitors are urged to examine the parts, as well as the finished compressors.
3. Two air compressors will be given away as prizes. One is to be awarded Friday and one on Saturday. The winning visitor need not be present at the drawing to win. The only requirement for a chance to try for one is that the visitor sign his name and address on a card when he visits the machine shop exhibits. Two drawings will take place, and the time of each drawing will be posted in the machine shop each day.
4. All of the machine shop is not used in the production of air compressors. Since the machine shop maintains its own machines, some "toolroom" type machines are used for unusual jobs that may come up from time to time. If one of the machines are used in production breaks down, men and machines are available to repair the damage immediately and production resumes.

AUTOMOTIVE LABORATORY

Mechanical Engineering

Engines on Display:

1. Hudson, 1947, 6-cylinder
2. Olds, 1948, 8-cylinder
3. Pontiac, 1948, 8-cylinder
4. Pontiac, 1942, 8-cylinder
5. Pontiac, 1942, 6-cylinder

The above engines are on display in assembled condition.

Dynamometers:

1. Ford V-8 used to determine the characteristics of the engine such as Brake Horsepower, Fuel Consumption, Torque, etc.
2. Chevrolet 6—same as above.

The Ford exhibit will be in operation during the open house.

Cutaway Chassis:

We have a cutaway model of a DeSoto showing all the parts of a modern car including engine, gears and rear end.

Cutaway model of a Timkin 2-speed heavy duty rear axle.

A large Hercules-Diesel engine

A display of many of the new cars of today just outside the automotive lab. Among the new cars will be seen a 1901 Oldsmobile.

WOOD SHOP

Mechanical Engineering

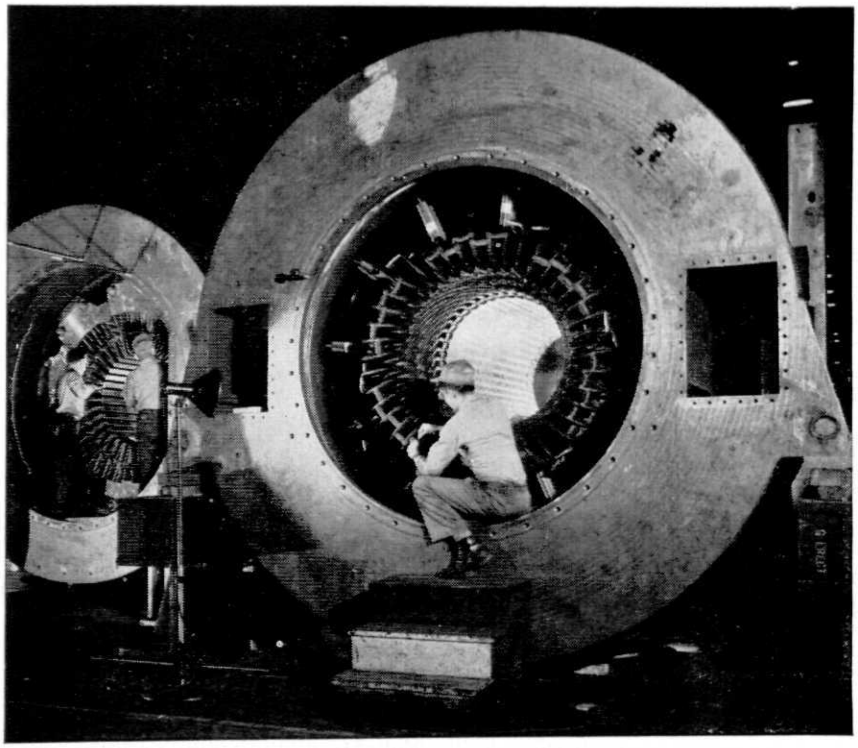
Classes will be in the Wood Shop Friday 12-6 and Saturday 8-11 A.M.

1. Patterns made by students in their regular classes in the wood shop are displayed on tables and may be examined by spectators. Special patterns, and those of an unusually intricate nature are shown in lighted display cases.

Continued on page 26

Get a Close-Up OF THE BASIC INDUSTRY OF YOUR CHOICE!

by R. S. FLESHIEM
Manager Electrical Department
ALLIS-CHALMERS MANUFACTURING CO.
(Graduate Training Course—1904)



Inside View of a hydrogen-cooled steam-turbine generator. A-C Graduate Training Course students may follow important electric power equipment from blueprint to installation.

WHEN YOU GET into daily working contact with an industry, you may find it offers specialized opportunites that you hadn't known about before. That's why it's not always possible—or wise—to pick *your* final spot in industry until you've had some all around first-hand experience.

R. S. FLESHIEM

I want to suggest a good way to *get* a close-up of the industries that appeal to you.

Naturally, I can talk with most assurance about the electric power industry. But the same principles apply to others.

When I got my engineering degree from the University of Michigan, the electric power industry was a fast-growing youngster. I decided to go to Allis-Chalmers, where I joined the company's first Graduate Training Course in 1904. I was sent to Cincinnati and started in the old Bullock Electric Mfg. Co. plant that Allis-Chalmers had purchased that same year. Bullock, incidentally, started in 1884—one of the real old-timers in the electric industry. It was the start of the present Allis-Chalmers Electrical Department.

Opportunities Are Increasing

The industry was growing fast at the turn of the century, but it's growing even faster now. Opportunities were never greater—or more varied.

Studying power and capacity factors in ore crushing, in Allis-Chalmers' complete basic industries laboratory. Camera-recorded data will be applied to commercial mining operations.

Today we have Graduate Training Course engineers applying their ability and training to the problems of machine design—research and development—manufacturing and production—sales—application engineering. Here we're working with electric power generation, control and utilization—with advanced industrial uses of electronics—with research in D. C. transmission. We're in intimate touch with the electric power industries—with transportation—with steel, metal working and other big power users. And I know that the field is just as broad in the other major industry departments here at Allis-Chalmers.

What Industry Interests You?

I firmly believe that Graduate Training Course engineers have a unique opportunity at Allis-Chalmers. They have the opportunity here to explore thoroughly not one, but many basic industries if they choose. This company produces the world's widest range of major industrial equipment, and every department is open to the graduate engineer. That includes electric power, mining and ore reduction, cement making, public works, steam turbines, pulp and wood processing. It also includes the full range of activities within each industry: design, manufacturing, sales, research, application, advertising.

Graduate students help plan their own courses at Allis-Chalmers, and they move around a good deal. It's possible for a man to come here with the idea of designing electrical equipment—later become interested in manufacturing—and finally find his greatest satisfaction and success in sales work. Men move from department to department, getting a practical working knowledge of each. And—the departments get to know the men. Opportunities present themselves according to ability.

At the completion of the Graduate Training Course, you've had a close-up of many industries. You're ready to take your place in the work of your choice.

Write for details of the Allis-Chalmers Graduate Training Course—requirements, salary, advantages. Representatives may visit your school. Watch for date.
Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

EXHIBITS

Continued from page 24

2. The pattern and core set up for an engine block is a display by itself. All cores and the boxes from which the cores are made will be arranged in the sequence they would occur in if the block actually were in production.
3. The wood shop is equipped with a complete line of modern, efficient power tools. Some of the new ones which have been added recently are a jig saw with a 36″ square table, and a spindle sander. A saw filing machine will be demonstrated. It is used to keep the many saws in the wood shop in first class condition.

SHEET METAL SHOP

Mechanical Engineering

The sheet metal course is not being taught at M.S.C. this term and no classes will be in attendance. Eugene Szakatits, senior from Hammond, Indiana, will be in charge of demonstrating and describing the machines. Some interesting machines are:

1. Metal cutting saw, forming rolls, press brakes, metal slitting saw, and small spot welder.
2. Effort is being made to obtain enough sheet metal so that ash trays may be produced in the forming press while the spectator is present. If the visitors desire these ash trays, they will be available at a nominal fee.

OLD POWER PLANT

Mechanical Engineering

The exposition visitors are welcome in both the old power plant and the new South Campus building. In each a tour of the facilities and equipment will be conducted and all interesting operations pointed out. Senior Power Engineering students are on hand to act as guides and answer all questions. Transportation between plants will be provided.

CHEMICAL ENGINEERING EXHIBITS

The following unit operations will be on display in the industrial laboratory:

1. Distillation Column

   This unit separates mixtures of liquids which have different boiling points. By use of steam the liquids in the column are heated and separated.
2. Absorption Column

   The absorption column as used here absorbs carbon dioxide in water, that is, the water picks up carbon dioxide as it goes through the column.
3. Filter Presses

   The filter press separates solid material from a mixture of solids and water. Three types of filter presses are on exhibit: the plate and frame, the Oliver press and the Sweetland press.
4. Evaporator

   The evaporator boils the water off from a mixture of water and some other material. This evaporator is known as a double effect evaporator because there are two chambers in which the boiling of the liquid takes place.
5. Dryer

   The dryer is used to remove water from a solid material. This type of dryer on exhibit is similiar to a large oven.
6. Crushing and Grinding

   This equipment is used to crush rock to a desired size. Three types of crushers are on exhibit: the jaw mill, the rod mill and the roll mill.
7. Heat Exchangers

   The heat exchangers are used to heat water by means of hot steam. Two types of heat exchangers are on display.
8. Fluid Flow

   This exhibit demonstrates the flow of water and air through pipes, valves and other equipment.

Equipment on display in the fuels testing laboratory, 407 O.H.

Calorimeters

Calorimeters are devices used to determine the heating value of city gas, coal, and other fuels. By use of calorimeter tests the amount of heat that a ton of coal or a 1000 cubic feet of gas will deliver can be determined.

Lubricants and Motor Fuel Testing

The equipment displayed is used to determine the properties of motor oil, gasoline, and kerosene. The tests will show how certain fuels and oils will operate under varying weather conditions.

AGRICULTURAL ENGINEERING

There will be a shuttle bus carrying visitors to and from the Agricultural Engineering building on South Campus. Board the bus in front of the Chemical Engineering laboratory.

1. Rural Electrification Laboratory—Room 102—Electric motors, electric water heaters and farm freezers.
2. Refrigeration Laboratory—Room 106—This room is used to house experimental equipment in farm freezers, quick freezing apparatus, and various types of food processing equipment. Accurate scientific tests of home freezers are now under way in this laboratory.
3. Food Engineering Laboratory—Room 106—Automatic steam boiler for use in food processing plants, as automatic as your home refrigerator; commercial type ammonia refrigeration machines; heat exchanger plates used in milk pasteurizers; temperature control equipment capable of maintaining milk pasteurizing temperature within plus or minus one-quarter degree Fahrenheit. Stainless steel sanitary pipes and fittings used for conveying food products. Sanitary type stainless steel pumps used for pumping food products.
4. Farm Machinery Laboratory—Room 107—All types of usual farm machinery, including grain combines, tractors, mowing machines, hay balers, and plows. Ninety-five per cent of all this equipment is sent here on consignment without cost to the college. Practically all of the equipment shown here is of the very latest design and style.
5. Research Laboratory—Room 113—This room is headquarters for departmental research. It contains a machine shop and welding equipment for making up experimental apparatus. The Frost Prevention machine, special sugar beet seed planter, fertilizer attachments, experimental mixtures of concrete with corn cobs to produce low cost building material having better insulation properties, were all developed in this laboratory.
6. Wood Shop—Room 114—See woodworking machinery, paint room, models of farm buildings. Students build complete structures including pouring concrete base, and then moving it out through the side door when finished, thus acquiring complete experience in building a small structure.
7. Metal Shop—Room 115—This room contains welding materials, machinery, metal shop, sheet metal working equipment, pipe fitting tools, and the like. This room is used for training Farm Shop teachers principally, and also for shop courses given to all Agriculture and Agricultural Engineering students. Classes will be in progress.
8. Farm Structures Laboratory—Room 117—This room contains models of farm structures, also samples of building materials, floor, roof and siding samples. These materials are all used for visual education in the various courses, whether for Farm Structures or for the building of cold storage room.
9. Land Development Laboratory—Room 119—See portable irrigation pipes and spray nozzles for distributing water over the land. Over 500 installations of supplemental irrigation are in Michigan now. See various types of pumps in this room.
10. Land Development and Pump Laboratory—Room 1 (basement)—Note large tanks for circulating water and for use in testing of pumps. See deep well pumps, also low head drainage pumps.
11. Tourist and Resort Laboratory—Room 3 (basement)—This laboratory is headquarters for the research and extension work in the Tourist and Resort activities of the college. It represents a $400,000,000 annual business in Michigan. See the typical one-room cabin with furnishings, wall bed, complete kitchen cabinet unit including refrigerator, stove and sink, rustic furniture, typical wall section, heating equipment, special type of chimney prefabricated, also shower. Fire prevention and safety exhibits, also landscaping and cabin arrangements around a lake.
12. Rural Electrification and Farm Structures Laboratory—Room 6 (basement)—This room contains many labor-saving devices with actual furnished items such as can racks, milk cooler, water heater, and the like. The milking machine, model of a barn cleaner (pushbutton-controlled) which cleans the barn in 2½ minutes as compared to 1½ hours by hand. See example of concrete block construction.
13. Student Club Room—Room 7 (basement)—This is headquarters for the student A.S.A.E. organization for lounging and reading.

Continued on page 30

H. W. FRITZ, SR. M.E.

PROFS ON THE RECEIVING END

A strange sight to students, imagine, a prof takin' notes. Upon a closer inspection we see it is actually a refresher group of the Engineering Faculty interested in the current movement in the registration of Professional Engineers. As can be seen, our Dean, Mr. L. G. Miller, is present at these refresher classes and he was overheard to say, "If my staff can do it, I can do it, too." The refresher classes are entirely the work of the C.E. department under Prof. C. L. Allen, Assisting Mr. Allen are profs. G. C. Blomquist, A. H. Leigh, L. V. Nothstine, and K. A. Campbell.

REGISTRATION EXAMS

MANY SENIOR ENGINEERS have never been initiated as to the full connotation of the title and the process involved in becoming a "Registered Professional Engineer." This article is written with the intention of answering some of the questions concerning the registering of professional engineers.

Engineers are accustomed to refer to themselves as members of a profession, as do doctors and lawyers. Engineers have also banded themselves into various organizations of which the most important, and perhaps the ones having the most influence on their profession, are the chapters of Registered Professional Engineers.

As in law and medicine, there is a necessity for examining, accepting, and regulating a profession where the safety and welfare of the general public is involved. Thus, it is possible to see that the purpose of registering engineers is namely:

1. to control and improve the quality and competency of the members in the engineering field so as to protect the safety and welfare of the general public.
2. to prosecute members and non-members whose practices endanger humanity, and to protect the public and profession against malpractice.

Every state has recognized the need for stamping its approval upon the engineer who practices for the public within its borders. Accordingly, each state has passed legislation to insure that these engineers be thoroughly trained, reliable, and competent. Most states have agreements whereby there is an acceptance of the legislation and the licenses of other states. This, however, does not apply to all states.

Knowing the purpose and the need for registration of engineers, the student inquires, "How can I become a registered engineer?"

According to the Registration Act for Architects, Professional Engineers, and Land Surveyors (Act

240, P. A. 1937 of Michigan) the qualifications and procedure are as follows: The applicant must apply to the Registration Board of Examiners 5 weeks before the examination date. With the application he must submit an up-to-date transcript of grades and a fee of fifteen dollars which will give him the privilege of taking the 3 parts of the examination (any part twice if it is necessary). The applicant must be a citizen of the United States of America, and 21 years of age. He must have had 8 years of professional experience, or be a graduate of an accredited school of engineering with 4 years of experience in an accepted professional field. No more than 5 years experience will be given for academic training. If accepted by the board of examiners, the applicant must pass a series of 3 examinations, given in 3 parts. A graduating senior may take the first part of the examination at any time. The sooner, the better. It has been found that the student has the least difficulty with part one of the examination if it is taken upon or pending graduation.

The student isn't registered as yet. With no previous professional experience, the student with a B.S. in engineering must wait 4 years before he is able to take the remaining two parts of the examination. These 4 years must be spent in an acceptable professional manner in the engineering field. Upon the successful completion of the series of examinations, the applicant will pay an additional ten dollar fee, and then receive his certificate of registration.

Knowing the weaknesses in the present Registration Act for Professional Registered Engineers in Michigan, there is legislation pending before Michigan legislators which will more closely define the professional engineer and strengthen the position and prestige of Michigan Professional Registered Engineers.

Let it be said at this time that there are two unfortunate situations existing in professional engineering. That is, there is nothing that highlights the event of the cub engineer into the profession of his choice. There is no Hypocratic Oaths as is found in the medical profession. There is no ceremonial induction or universally accepted code of ethics that will serve to guide the engineer in his practice. However, there are influences at work which are hoped to correct this in the future.

Applications and information can be obtained by writing to: Executive Secretary, State Board of Registration for Architects, Professional Engineers, and Land Surveyors, 307 Cadillac Square Building, Detroit 26, Michigan.

It has been announced that the examinations will be given here at M.S.C. this June 17th and 18th. Mr. Blomquist of the C.E. Department is available at his regular office hours for questions and advice.

Mechanical Engineering Seminary

Something new has been added to the senior Mechanical Engineering Seminar. Instead of listening to each other, as in the first two terms, the Spring term is being devoted to the presentation of outstanding engineers. Each guest speaker discusses a problem of interest to engineering students.

So far the group has heard James R. Longwell, Plant Manager of the Carboloy Co., Detroit, who spoke on "Cub Engineer to Plant Manager"; Prof. G. C. Blomquist on "Engineering Registration"; John R. Bangs, Director of Personnel and Industrial Relations of the Budd Co., on "Personality in Industry"; and W. A. Vander Eyk, of the Michigan Bell Telephone Co., on "Labor Problems."

Speakers to come include Philip J. Baker of Motor Wheel Corp. on "Patents and the Engineer"; O. D. Trieber, Consultant for Hercules Motor Co., on "What the Graduate Engineer Can Expect from Industry"; Howard E. Blood, President of Norge Division, on "Free Enterprise and the Engineering Graduate"; and Senator Ralph E. Flanders of Vermont on "The Engineer as a Public Servant."

A few dates remain to be filled according to Prof. James M. Apple who is planning the program.

EXHIBITS

Continued from page 27

This building is designed to serve agriculture, not only from the standpoint of training students but also for farmers, manufacturers and others who are interested in all types of farm machinery, farm structures, irrigation, processing, and the like.

Every few days through the year, there are large delegations of from 20 to 300 people visiting here and learning or familiarizing themselves with the newest developments in all these different lines of work. This building was designed to be of service to all of the people of Michigan.

1. Induction Heating

   The heating of magnetic materials by radio frequency magnetic fields is demonstrated by a 1 kilowatt, 300,000 cycle/second vacuum tube oscillator.

2. Radiation of Radio Frequency Fields

   The presence of radiant energy is illustrated by the lighting of a conventional fluorescent tube from the radio frequency fields produced by an R. F. Oscillator.

3. Transmission of Voice on a Light Beam

   A modulated light source and photocell illustrate that sound and voice waves can be transmitted from one point to another on a beam of light.

4. Electronic Welding

   A commercial, electronically controlled, spot welder demonstrates the use of Mercury-filled tubes for the accurate and precise control of welding current in the welding of small metal parts.

5. Stroboscope

   The stroboscope is a flashing light source used to produce a stationary image of a moving part so as to indicate its speed of motion.

6. Servomechanism

   A servomechanism is used to control the position of some object from a remote point; the only tie between these points being an electrical one.

7. Vacuum Tube Demonstration

   The action of the control grid of a vacuum tube on the flow of electrons within the tube is illustrated by bombarding a fluorescent plate which gives off visabal light when struck by an electron.

8. Electromagnetic Induction

   The presence of eddy-currents produced by electromagnetic fields is illustrated by heating a frying pan with no source of heat.

9. Photoelectric Counting

   The interruption of a light beam can be used to count these interruptions at very high rates of speed.

10. Electronic Motor Control

High vacuum and gas-filled tubes can be used to accelerate motors, control their speed, and stop the motor rapidly.

11. X-Ray

A 150,000 volt, Industrial X-Ray machine and its controls can be used for the detection of flaws in metal parts. (Because of the danger of excessive exposure to x-rays this machine will not be turned on.)

12. Oscillograph

The oscillograph is a device for transforming electrical impulses into visual traces on a flourescent screen.

13. Precipitron

The precipitron is an electrostatic air cleaner used to remove all foreign particles from the incoming air.

ST. PATRICK WAS AN ENGINEER

Continued from page 18

hibits which the students had been able to think up for the occasion. Some of these were put on year after year and never failed to draw a crowd. Some were not so educational, but most of them were, and in spite of all the chest-thumping and letting off of steam, nevertheless they accomplished a great deal by way of educating the public and quickening its interest in engineers and their usefulness. Many of the students devoted long hours of work to getting up the exhibits; such, for instance, as those who made models of engines which ran under their own power, those who made the Toonerville Trolley which actually carried passengers across the campus on a track which was laid the night before, and still others in later years who operated a miniature steam locomotive which succeeded the Toonerville Trolley. All of these students gained a great deal of good experience in this work, and their satisfaction was a pride of accomplishment which is its own reward.

The crowning event of The Day was, of course, the Engineers Ball that night, when Saint Patrick and his Queen were unmasked and joy was unconfined. Nobody was supposed to come to the Ball except Engineers and their friends. Of course it was usually impossible to keep a few tickets out of the hands of uninvited outsiders, but they were few indeed, and their holders had better behave themselves. Somebody always saw to it that there was plenty of stags. In that way no girl ever missed a dance. It worked the popular ones nearly to death but they loved it.

RETIREMENTS

Continued from page 11

civilization or some other equally profound topic. It is to be noted, however, that teaching of engineering has always come first with Prof. Foltz and that his office has always been open to any stymied student. Incidentally, it is probable that the stymied student learned of the importance of basic principles while conversing with Prof. Foltz.

Leroy Stewart Foltz was born in Chandlerville, Ohio, in 1889. He received his B.S.E.E. from the University of Illinois and his M.S. from the University of California. His industrial experience began as a draftsman with the Electric Wheel Company, after which he worked as an electrical engineer for the Maytag Company and following this, as an electrical engineer for the Illinois Traction Company.

The years 1913-14 found him as assistant professor at Colorado State College. Next, he became an associate professor at the University of California and then professor at Colorado State. In 1918, he became an associate professor at Michigan State College and professor in 1925. At this time he became head of the Electrical Engineering department, and served in that capacity until 1948.

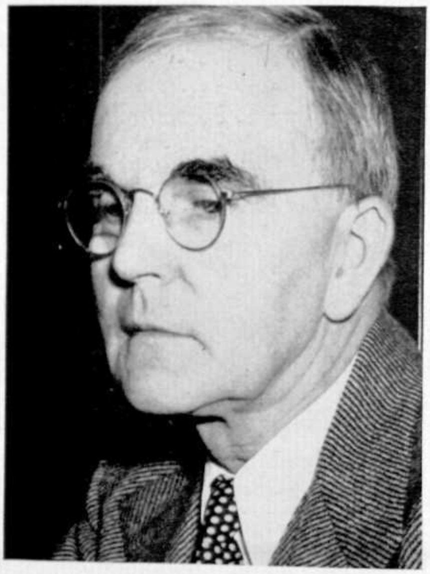
Prof. Foltz has taken an active interest in the Amer. Assn. of Engineering Education, A.A.U.P., and A.S.E.E. He was particularly instrumental in organizing the Lansing Engineers Club, of which he was twice president, and he also was one of the organizers of the Michigan State College Chapters of both the American Association of University Professors and the American Society of Engineering Education.

The professor's avocations are reading, firearms (he is a member of the National Rifle Association) and occasional writing of poetry. He is also very interested in the Fellowship League of Peoples Church.

Prof. Foltz believes the student should attempt to maintain his physical, mental, moral and spiritual well being if he seeks purpose in his career. In this respect, he is rather skeptical of certain trends in modern society which tend to soften any of these qualities in the individual. The students in particular should not erect limitations (such as the eight hour day) on their efforts and should keep in mind a basic truth which is, "Only the student can educate himself."

Mr. Sangster Retires

Prof. Sangster, fondly remembered by thousands of alumni, is sure to be missed by all engineering students when he retires this June. In any gathering of engineering students, a reference to the forge shop is certain to bring forth expressions of admiration for Mr. Sangster's remarkable "smithing" ability, his sharp wit, and his sound knowledge of metal processing. Nor does anyone fail to remember his smooth and efficient demonstrations accompanied by instructions delivered in a calm and Scotch burred voice, amid the glow of a "well built" fire and the measured din of an educated hammer.



Professor Sangster

Bert Sangster was born in Aberdeen, Scotland, in 1883. After attending Gordon's College, now part of Aberdeen University, he served five years as a tool smith, a job involving tool hardening and heat treat work. In 1905 he came to America and worked in various steel mills which incidentally took him to New York, Philadelphia, Birmingham, Chicago, and various other steel producing cities. This enriching experience was interrupted when he volunteered in the Canadian Army during World War I. Upon his discharge from the service he joined the Buick Motor Car Company for which he worked until he became a member of the mechanical engineering department of M.S.C.

It is not surprising that his three sons have attended Michigan State College. John and Bert, Jr., were members of the classes of '38 and '42, respectively, while George, a civil engineer, will graduate this June.

The most noticeable change Mr. Sangster has observed in the school during his thirty year tenure at Michigan State College, has been the decrease of the "Ra-Ra" spirit among the students. Although he believes a trend toward a more serious attitude has brought about higher academic standards, he is of the opinion that the old school spirit made the school more enjoyable, more human, and forged lasting friendships; features that he thinks should not be completely disregarded.

The Professor's hobbies are biking and writing. He has contributed frequently to the American Iron Smith and other technical journals. He also has published poetry. His poem "The Campus" which dwells upon the beauty of the campus bears out his contention that if he had it to do over again, he would most assuredly repeat those thirty years as a staff member of Michigan State College.

SOIL SCIENCE

Continued from page 12

resistors is a standard resistance which does not vary with temperature. The resistance of this element is constantly equivalent to that of a temperature of 32°; thus, there is a visual check every fifteen minutes as to the accuracy of the recorder.

Provisions have also been made to measure the moisture variations in the first 60 inches of soil in each watershed. Marked changes in percentage of moisture at the different levels of the profile are found with variation in cover and cropping practices. The moisture sensing elements, "Bouyoucos blocks," were developed and perfected by Dr. G. J. Bouyoucos and other members of the staff here at Michigan State College. They consist of two electrodes insulated from each other by a highly porous material, and are buried in the soil at different levels of the profile, where they rapidly absorb moisture until they are in equilibrium with the soil. When dry, the insulation of these elements is nearly perfect and constitutes a very high resistance between the electrodes when a current is introduced into the circuit. However, the insulating properties and resistance of this material are each markedly reduced by the absorption of soil moisture, so much and uniformly so, that a measurement of the resistance of one of these Bouyoucos blocks and the comparison of that resistance with a calibration chart will give a precise value for the amount of soil moisture present at that point. Resistance of these blocks scattered over the different watersheds is measured by remote control on an especially modified Wheatstone bridge. The resistance of Bouyoucos blocks is also effected by variations in temperature; therefore, correction is made for the temperature of the soil at the location of each block at the time of reading. These temperatures are measured on a portable potentiometer which is calibrated in degrees Fahrenheit. These readings are also made by remote control. Other precision instruments located in this building are wind velocity, direction and total mileage recorders.

Recording Radiation

Solar and sky radiation, as measured and recorded, is converted from milivolts of electrical energy to gram calories of heat energy per square centimeter by means of plainimetric analyses. Through the applica-

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Figure 2.—INSTRUMENT PANEL.

Lower left: Selector switches for moisture block temperature circuits.

Lower center: Selector switches for moisture block circuits.

Bottom right: Wheatstone Bridge for soil moisture determination.

Top center: Micromax recording potentiometer.

Upper right: Micromax recording bridge.

SOIL SCIENCE

Continued from page 35

tion a plainimeter conversion table and a good calculator, this conversion becomes routine. Solar radiation received at East Lansing is then compared graphically and statistically with that received at other stations over the country. It is interesting to note that radiation received at this station compares more favorably with that received with Fairbanks, Alaska, than at any other smoke-free station of record; but the fishing is better in Alaska.

Figure 3.—Measuring a run-off.

Through the use of the instruments which have already been described, it is possible to follow the day-to-day movement of moisture in the soil, thus, in a measure determining crop usage of the moisture and conversely, crop requirements of moisture. A refinement of this study, which will permit the automatic measurement of soil moisture at fifteen-minute intervals continuously, is planned for early installation. An automatic conductivity register is being especially adapted for this purpose.

Evaporation Losses

One contributing factor to loss of soil moisture, other than that lost through percolation or plant use, is evaporation. Evaporation losses are related intimately to rate of, and total wind movement, as well as atmospheric humidity and solar radiation. Direction, velocity, and amount of wind are measured by a transmitting direction and velocity register and recorded by remote control in the instrument house. At the same time the total wind movement is recorded in miles of wind. A mile of wind is defined as a wind blowing for one hour at a velocity of one mile per hour. Humidity is measured and recorded along with atmospheric temperatures by means of a hygrothermograph. maximum, minimum, and current thermometers are used in conjunction with the hygrothermograph.

Evaporation from a free water surface is measured and recorded by a "black-pan" evaporimeter. This is a homemade device utilizing the weighing and recording unit of a Ferguson type recording raingage, which is calibrated to read to the nearest 1/100 inch of rain in an eight-inch cylinder. By keeping a continual record of the weight of a cylinder having ten times this area evaporation loss to 1/1000 of an inch are obtained.

Precipitation at the watersheds is measured with three different types of raingages. The Ferguson weighing and recording raingage is used to record the intensity of precipitation in inches per hour, time of precipitation, and duration of precipitation. The U. S. Weather Bureau standard nonrecording raingage is used to give total precipitation, and compared with a similar raingage mounted in an areo-dynamically designed Nypher shield.

Visible Water Loss

The instruments described up to now measure the precipitation and its invisible loss. The other instruments on the project are designed to measure the visible water losses. To accomplish this, all surface runoff from the watersheds is channeled through a calibrated type 3-H wier, or flume. The water stage, or depth of flow, is recorded on a clock-driven recorder. Thus, time and depth of flow are known, and with size of orfice, the volume of runoff can be computed. Figure 3 demonstrates this installation very well. In the center foreground is the runoff recorder with the pen registering at the .3 inch mark. Lower left is the flow through the calibrated type 3-H flume. After measurement, this flow is caught in the silt basin at the extreme lower left, and samples taken therefrom. By means of analysis and expansion of these samples, soil losses from the entire watershed can be computed. Under conditions of severe runoff stones as large as two inches in diameter have been deposited in the approach section to the flume.

Final Evaluation

The overall relation of all this data to the question of soil and water losses and water movements is obvious, but the specific relation of each item to the others is a matter for considerable conjecture. The evaluation of the entire problem and its component parts presents an enormous problem. It is here that an engineer realizes something of the scope of technical problems confronting agriculture, and it is also here that one acquires an appreciation of statistical analysis. Results of the research work carried on in this project are beginning to solidify. Evidences are accumulating, and with time and more data, the intimate relations of soil moisture, precipitation, solar radiation, soil temperature, wind, and evaporation to runoff and erosion will be more nearly evaluated. This evaluation should enable us to develop more and better soil and water conservation practices.

METAL—INSIDE OUT

Continued from page 14

even the subject of inclusions in metal needs further research. Any abrasive inclusions obviously will shorten tool life and increase power requirements. Yes, machinability is a big problem but at least there is now a known method of approach and an accurate means of "seeing" into metals.

The science of metallography is just one phase of the larger field of metallurgical engineering. Most of the objects that are so common in our daily life are made of metal. We are accustomed to assuming that they will function properly. Certainly all engineers as a group would greatly benefit from an understanding of the basic principles and concepts of metallurgy. Engineers can more intelligently and effectively use metals when they learn to see and understand the metal—inside out.

ONCE UPON A MOON

Continued from page 13

Ray's recollections of his whereabouts during those three fantastic days are somewhat confused, but of one thing, he is certain: "I tell you Sam, I was on the Moon! I can remember looking up in the sky, and seeing the Earth, as big and fat as a watermelon . . . I walked on the Moon, and there was air there, and a kind of strange life, and a lot of things which I can't clearly remember. . . . But Sam, I *know* I was on the Moon."

Which was perfectly ridiculous, as everyone knows it has been fully three weeks since the Moon blew up . . .

SOCITIES

Continued from page 16

The April 6 meeting was restricted to a brief business session in order that members might attend the showing of the Burroughs Adding Machine Company's film "In Balance," dealing with the necessity for profits in private enterprise.

The annual banquet was held April 20 at the Hunt Food Shop. Speaker for the occasion was "Jack" Frost, of the State Stream control Commission, who spoke to the chapter on the problems of industrial polution of streams throughout Michigan. At the conclusion of his talk Mr. Frost vividly emphasized the extent of polution by showing aerial photographs of contamination in the Detroit River and vicinity.

American Society of Civil Engineers

The last meeting of the A.S.C.E., held on Thursday, April 21, was devoted principally to the business on hand. President Paul Spellman conducted a more or less open discussion of future events. The major topics brought to the floor were the coming dance, which is to be held in the Foresters' cabin on Friday, April 29, and the mixed faculty-student picnic to be held at Grand Ledge the latter part of May. The coming Engineering Exposition and A.S.C.E. banquet also received due consideration.

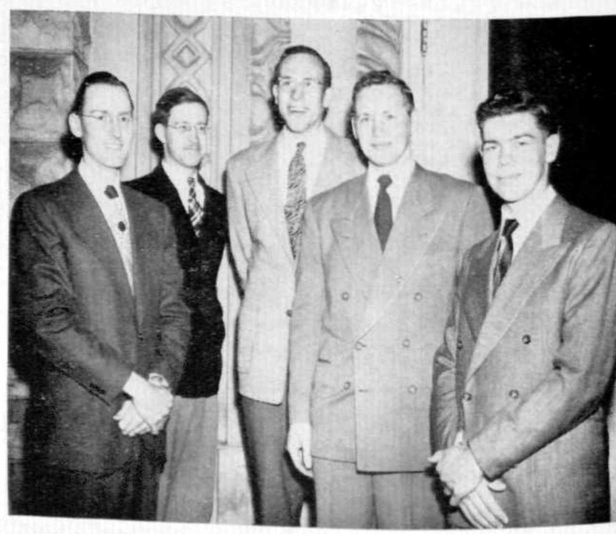
A. S. C. E.

Left to right: Hubert J. Haley, Treasurer; L. S. Taylor, President; E. W. Umiker, Secretary; and John Landon, Vice-President.

The rest of the meeting concerned the election of officers for the coming year. Elected were: L. S. Taylor, President; J. M. Landon, Vice-President; H. J. Haley, Treasurer; E. W. Umiker, Secretary.

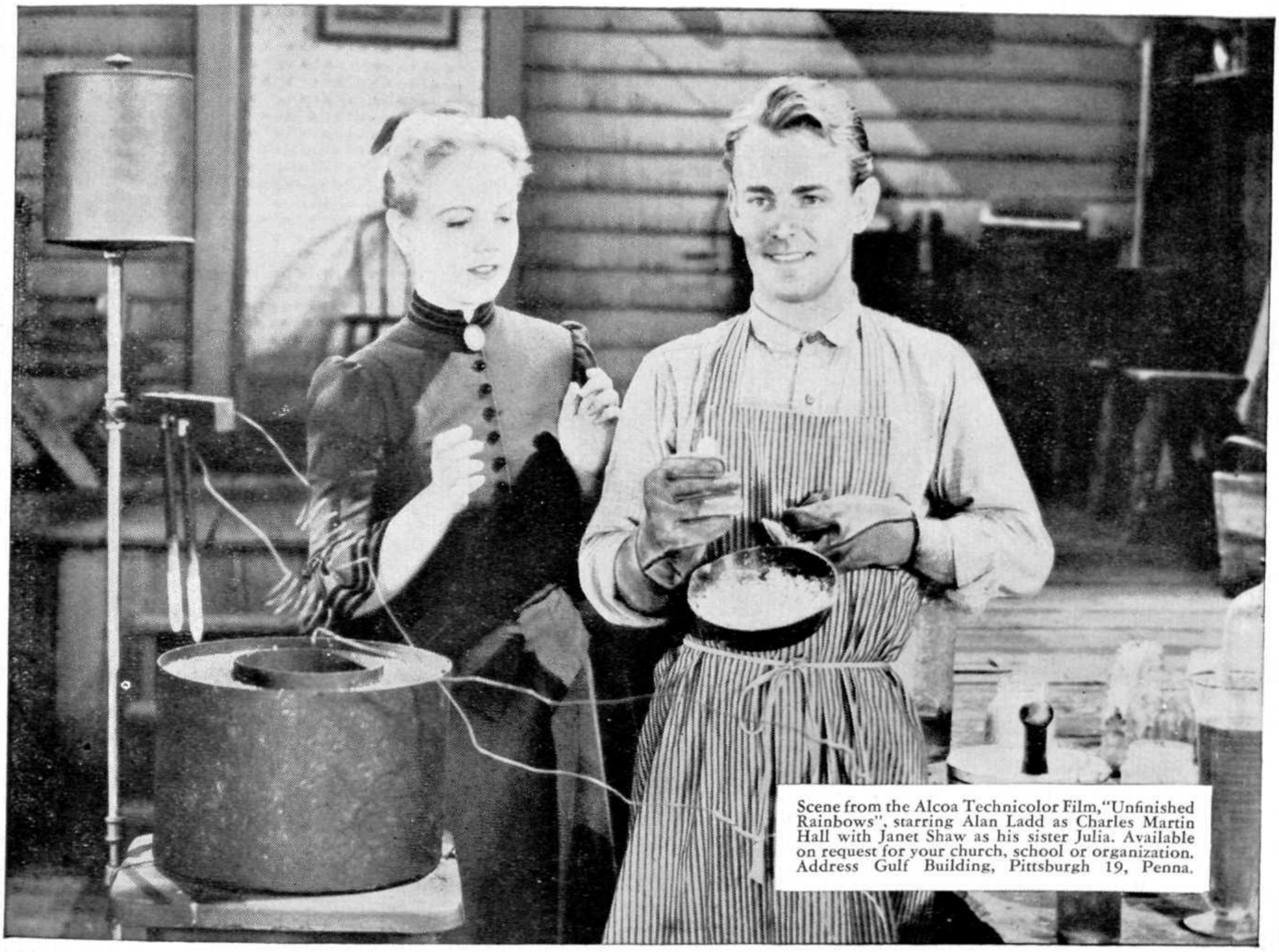
Sigma Pi Sigma

On April 13 the Honorary Physics Society met to approve new candidates and appoint committees. A nominating committee and another to arrange an exhibit for the Engineering Exposition were selected. A "Prize" committee



Sigma Pi Sigma Physics Honorary Officers

Left to right: Harry Macy, Secretary; Dr. Noble, Faculty Advisor; Robert E. Houston, Treasurer; Richard Kropschot, Vice-President; and John A. Brinkman, President.



Scene from the Alcoa Technicolor Film, "Unfinished Rainbows", starring Alan Ladd as Charles Martin Hall with Janet Shaw as his sister Julia. Available on request for your church, school or organization. Address Gulf Building, Pittsburgh 19, Penna.

ALAN LADD now co-starring in "WHISPERING SMITH", a Paramount Picture. Color by Technicolor.

How a group of American pioneers has held the price of Aluminum down

Charles Martin Hall, founder of America's aluminum industry, had a special kind of gleam in his eye. Every one of us has it too.

He was bound and determined to find a way to make aluminum cheaply. The schoolbooks all tell how he did it, where the world's greatest scientists failed.

Bluntly speaking, Charles Martin Hall set out to cut the world price of aluminum.

He was the first of the men and women of Aluminum Company of America. He licked a process. We who followed him—engineers, chemists, metallurgists, physicists, production experts—have been at it ever since.

But the gleam is the same. It's bumping elbows in the research lab with men who, in fifty years, have accomplished most of the finding-out that took fifty centuries, with the age-old metals.

It's working in the mill and having it seem that every shining sheet racing over the rolls is your own.

It's typing a letter in answer to a simple query, and having the deep-down feeling that you may be in at the birth of a new business, taking root in aluminum.

We propose to keep on being pioneers in broadening the usefulness of aluminum. Alcoa Aluminum sold in 1939 for 20 cents a pound. It sells today for 16 cents.

We are pioneering with microscopes and calipers and rolling mills. We'll stack them against axes and squirrel rifles and spinning wheels, for a place of importance in the history of our America.

To know other stories of the Alcoa family and the growth of aluminum's usefulness to you, write for free copy of "Aluminum—Its Story", ALUMINUM COMPANY OF AMERICA, *Gulf Bldg., Pittsburgh 19, Pa.*

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

was appointed to investigate and determine basis for awarding prizes for the best show case in the new Physics Building. A fourth group will arrange a picnic for the S.P.S. on May 25.

Tau Beta Pi, Engineering Honorary Officers

Front row, left to right: J. T. Anderson, Faculty Advisor; Jan-Erick Aarberg, Corresponding Secretary; Blaine Cadwell, Vice-President; Leroy Genaw, President.
Back row, left to right: Glenn Ogletree, Engineering Council Representative; Marvin Bicknell, Recording Secretary; Dick Keinath, Cataloger; Edwin Bozian, Engineering Council Representative.

SIDE TRACKED

Tourist: "And how is your good wife, Sultan?"
Sultan: "Oh, she's all right, but the other forty-nine are more fun."

★ ★ ★

Freshman: "What is the difference between a sewing machine and a girl running for a trolley."
Senior: "A sewing machine has only one bobbin."

★ ★ ★

I never kiss, I never neck,
I never say hell, I never say heck;
I'm always good, I'm always nice,
I play no poker, I roll no dice.
I never drink, I never flirt,
I never gossip or spread the dirt;
I have no line or funny tricks,
But what the hell,
I'm only six!

★ ★ ★

Jake: "Let's give the bride a shower."
John: "Count me in—I'll bring the soap."

He (tenderly): "Shall we go inside and listen to the radio?"
She (wise gal): "No, I'm too tired—let's play tennis."

"—And this is my little brother."

Photography can make this page

this  small

IT'S DONE WITH MICROFILM MAGIC

TINY AS IT IS, the little rectangle above is this page in black and white—as it appears on microfilm. Everything there, condensed to a mere spot, but ready to be brought back full size with all its features intact. For photography can reduce tremendously without losing a detail.

As a business or professional man, you can utilize photography's reducing ability in any of many important ways.

You can utilize it to save space . . . to speed reference. With Recordak microfilming, you can "debulk" files 99% . . . keep the records at hand for quick viewing, full size, in a Recordak Reader.

You can utilize photography to make sales presentations more complete, more resultful. With motion pictures, you can "pack" a plow, a plant, a whole process into a small can of film . . . travel it where you will, show it off "large as life" and much more dramatically.

Only a suggestion . . . this . . . of what photography can do because it is able to condense. And because it has many other unique characteristics as well, photography is becoming an increasingly important tool all through science, business, and manufacturing.

Whenever you want to improve methods of recording, measuring, testing, teaching, or countless other functions, be sure to consider the unusual abilities and advantages of photography.

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