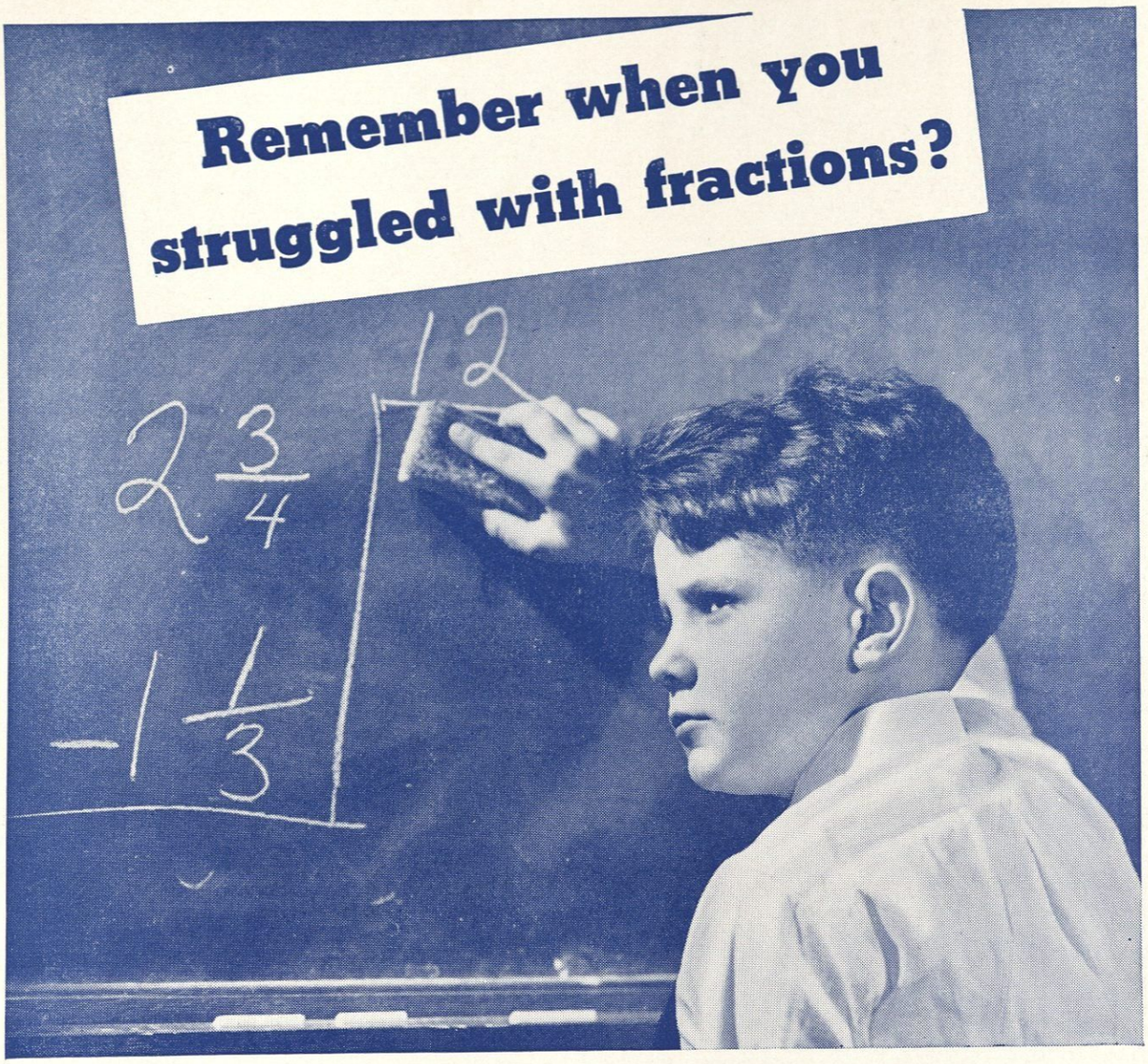
The COLORADO Engineer

JANUARY
1940

UNIVERSITY OF COLORADO

MEMBER OF ENGINEERING
COLLEGE MAGAZINES ASSOCIATED



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BUSINESS MANAGER

The Colorado Engineer

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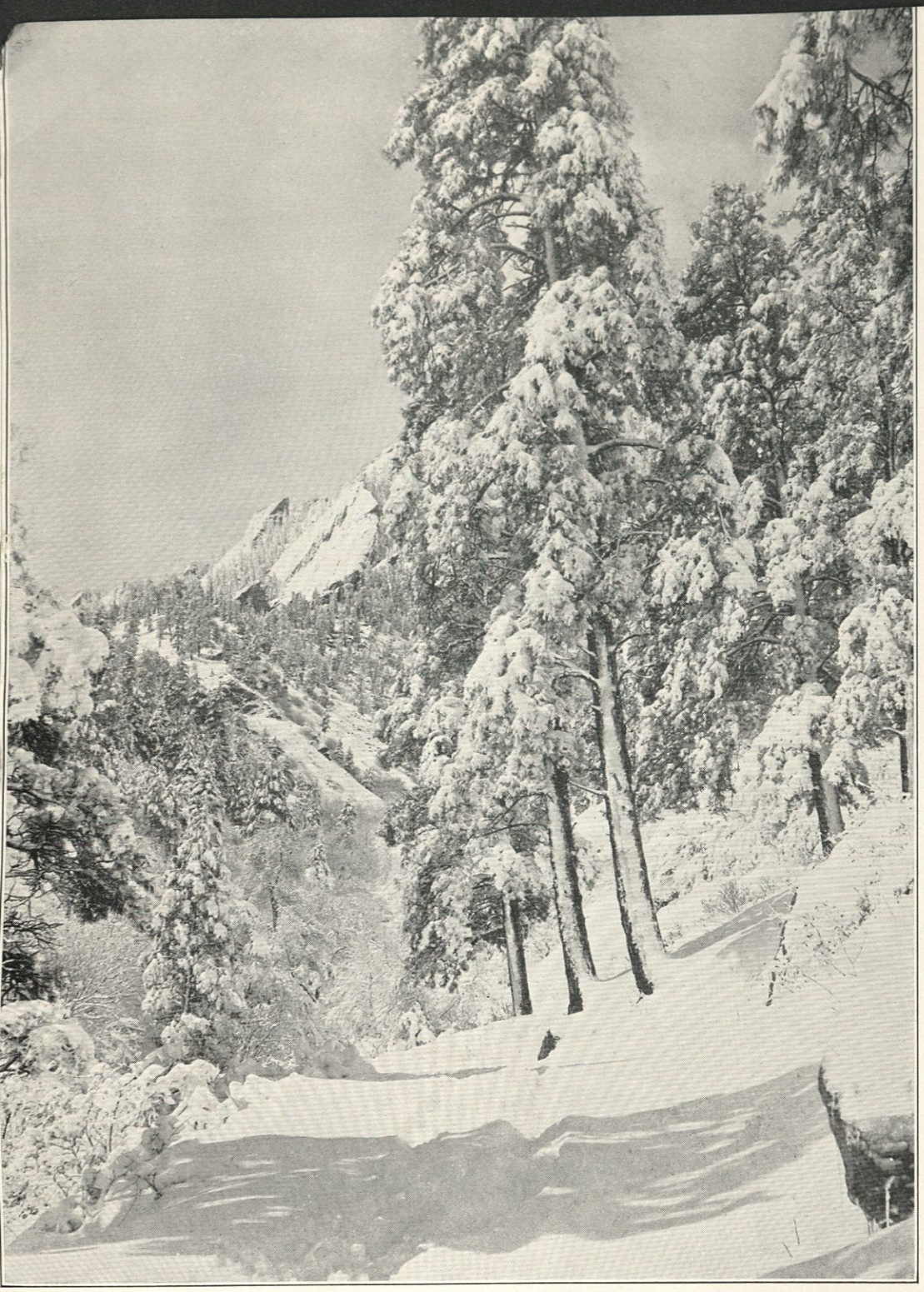


Photograph by Snow

. . . Winter

Tailor-Made Houses

PREFABRICATION IN AMERICAN BUILDING

Clara M. Barnes, arch. '40

THE MOST familiar example of prefabrication is to be found in the automobile manufacturing industry, where separate units of the automobile are completed independently, so the automobile can be assembled in one continuous operation. Perhaps it is less obvious that these principles are being applied to the very important building industry, but prefabrication is playing an ever increasing part in the development of building.

Prefabrication is not a new building development, for it began long ago in the days of the old Babylonian kingdom. The first prefabricated units were the sun-baked bricks of uniform size used by Babylonian builders, which showed that even in those early times they realized the efficiency of preparing materials as completely as possible before erection. In our own country the pioneers furthered the advance of prefabrication with saw-mills to furnish prefabricated wood members in the form of studs, joists, and boards to take the place of logs hewn by hand. Later more time was saved by cutting studs and joists to proper width and length before delivery. Then as industrialization increased throughout the world, more units of a building became available to the builder complete and ready for installation, such as windows, doors, and entire steel trusses; until today every building can be composed of thousands of prefabricated units.

However, the term prefabrication has acquired a modern interpretation which will be adopted in this article. It has come to mean prefabrication applied to larger units in the elements of walls, floors and roofs. The prefabricated house is currently produced in two forms: (1) the complete or mobile house, assembled in the factory with services, decorated, and propelled to the site on a specially constructed truck; and (2) the panel house, consisting of panels for the walls, floors, partitions, and roofs, finished in varying degrees, shipped to the site, assembled and decorated. The first type is, of course, limited to operations within short distances of the plant, and involves special permits for use of highways and difficulties with overhead wires and trees; consequently the greatest interest will be in the panel house.

These new systems of construction are not fashionable fads, but have developed naturally to comply with changing industrial conditions and an increasing need for reduced costs and improved quality in building. The problem of low-cost housing has been brought more forcibly to our attention. The Housing Research Department of Purdue University found that three-quarters of the families in the United States cannot afford or safely finance a home which costs more than $5,000. Although new dwellings in the past have been built only for a very limited class, in prefabrication lies the hopes of the building industry to make all types of building more economical and especially to expand the market for houses into the low-income class.

How can prefabrication be a solution to this problem of housing? Twenty-five per cent of the selling price of a house goes directly to labor on the job, for it takes more than 500 operations and 20 individual trades to build a typical house. The most logical way to reduce the cost of building, therefore, would be to eliminate as far as possible field labor, which is always expensive. The cost of materials could be reduced by purchasing materials and equipment in large quantities from fewer sources. Prefabrication seems to take advantage of these savings and produces a cheaper house of better quality than has been possible before. The building concern sponsoring a prefabrication system can order materials more economically than an individual builder, and in its factory standard panels and sections can be built by skilled labor. These panels can then be transported to the site and erected in a very short time by a few laborers, with a great saving in labor costs to the builder.

New systems of construction and forms of design are being devised every day, and many are skeptical about such revolutionary changes taking place in the building industry, not realizing that new forms are a natural development and have been appearing over a period of many years. The problems of prefabrication have been carefully considered, for during the recent depression the slump in the building industry offered time for extended research on the subject.

Prefabrication is heartily supported by many prominent architects. Frank Lloyd Wright gives his support to prefabrication as the solution to the "American small house problem." He says, "What would be really sensible in this matter? To give the little family the benefit of industrial advantages of the era in which they live . . . It is necessary to get rid of all unnecessary materials in construction, necessary to eliminate field labor. And it would be ideal to complete the building in one operation as it goes along, inside and outside." For more than fifteen years Richard J. Neutra has worked on the devising of practical approaches to prefabrication and has originated a system known as the Neutra Diatom. When asked if he thought that prefabrication would sweep the country, he replied, "Only emotional outbursts sweep a country. Prefabrication is too sound and logical an outgrowth of American building industry and manufacturing methods to have anything but a sound and step-by-step development."

Plans for prefabricated houses can be made either by the architects of the building companies making panels or by independent architects. By limiting his dimensions to even inches any architect can adopt his plan to almost all prefabrication systems, thereby providing economical construction without limiting the scope of his creative ability in any way. Not all prefabricated houses have to be designed in the "modern" style that many potential home-owners think to be objectionable. Traditional design forms have been adapted to prefabrication, but today the wide range of new materials and the freedom allowed by new fabrication technics are a stimulus to the search for new design forms that follow function with more freedom.

There are certain disadvantages to prefabrication that prevent rapid advancement. The cost of houses that are being built by this method of construction is not as low as desired because the immediate demand is small, and it is difficult to gauge the coming market. This limits volume of manufacture and the planning of production is almost impossible. These buildings are hard to sell to the consumer because he is attached to conventional methods of erection. Liquidation and replacement of obsolete buildings is slow and difficult. Another obstacle that will take many years to overcome is the existence of many antiquated building codes that have no provision for these new building systems. Labor organizations in the building industry are fighting hard to prevent the introduction of methods which will reduce the amount of job labor, since the assembly of all of the parts of the prefabricated house above the foundations could be handled by a few skilled mechanics. Craft distinctions now existing in the building trades would be broken down, and many of the men now engaged in building construction would have to look to the factories for employment.

From the four-fold handicap of high cost, unfamiliar appearance, labor opposition, and unfavorable building codes, two will be quickly removed, and the others will undoubtedly follow. It is self-evident that as soon as a house better than the conventional one of the same price, less troublesome to build, more comfortable to live in, and more economical to build and maintain is produced and put on the market, the public will buy it and admire its appearance. The unfavorable attitude of the public is being removed gradually as model prefabricated houses are being built in many cities to give visible proof of the advantages of prefabrication. As public opinion is changed to favor prefabrication, the market will increase and costs will be lowered. Transportation costs will decrease as factories for prefabrication systems are placed more uniformly about the country.

The labor problem has been met quite satisfactorily by some of the producers of building units. Rather than anger the mechanical trades unions and the local dealers, they have set up the local builders as distributors, and often the lumber dealer becomes a branch fabricator. American Houses, General Houses, National Houses, Incorporated, and others distribute their panels through local builders, and roofing, siding, paint, etc., are supplied locally. Building codes will be changed whenever enough builders desire prefabricated buildings to demand a change. All these disadvantages can be removed by education of the general public, and a campaign for education has been steadily progressing for the last few years.

Of all the materials used in prefabrication systems, plywood appears to be most economical and most satisfactory. The new resin-bonded plywoods are stronger and tougher than solid lumber; they require no covering and provide a natural nailing base. Plywood is easier to transport than other materials because of the lightness of the units. Satisfactory panels are also made of precast reinforced concrete, and steel sections of various shapes.

Over fifty systems of prefabrication have been developed recently by different building concerns. For example, there is a plywood panel system using the "stressed covering" principle used in airplane construction, with two plywood faces separated by joists or studs and all inclosed space filled with blanket or loose insulation. One steel panel system consists of steel sheets formed in a W shape, spot-welded to flat plates, and locked together. Interior and exterior finish is applied at the building site. Another system is of precast concrete slab units locked together by welding projecting reinforcement and by poured concrete keys. Window and door frames are cast in the units, and all plumbing, heating, and electric conduits are built into the slabs.

Manufacturers of prefabricated sections are now concentrating their sales efforts on large scale projects instead of individual homes, for they would provide the major requisite of economical shop-fabrication—a concentrated market. The Federal Housing Administration has just completed fifty plywood houses at Fort Wayne, Indiana. The houses have been built by WPA labor; overhead, material, and land costs were $900 per unit (labor cost not included). Units rent for $2.50 a week, and erection of each unit at the site took only one hour and forty minutes. Buildings in the Desert Retreat at Palm Springs, California, were shop-fabricated of resin-bonded plywood in large units. The designers state that this type of prefabrication costs thirty-five per cent less than construction by customary methods based on contract proposals.

With the development of prefabrication has come a revolution in the building industry—new materials, new structural systems, and new design forms. All of these are expressive of the spirit of modern America and are being used more universally every year. The future of prefabrication seems to be secure since we have found that it makes possible new houses for the great average-income class—better houses for less money.

The Eyes Have It

THE MIRACLES OF POLARIZED LIGHT

Robert F. Hamilton, B.S. (M.E.) '20

WE ARE told that fully 85% of our external impressions come to us through our eyes. If this is true, then it is logical to say that anything that can make the task of seeing less difficult, or aid the eyes to do a task that they were unable to do before, is truly a milestone in human progress. The invention of Polaroid* material, by Mr. Edwin H. Land, is such a milestone. Very seldom are discoveries or inventions made which are so fundamental that, at the same time, they establish new procedure in industry, bring into being new industries, aid the arts and sciences and also gain the public interest. I want to point out a few of the applications of Polaroid film to show that this new material is one of the outstanding developments of our time.

Polaroid material is a thin, flexible, transparent cellulosic sheet, unlimited in area, in which are imbedded some thousand billion crystals per square inch, all lying parallel. Its function is to comb out, or rearrange, the vibrations of light that pass through it. It is important because it makes available to the public at large, for the first time, the control of one of the fundamental properties of light; namely, the vibrational-direction. The other fundamental properties of light are color and intensity.

Controlling the plane of vibration of light waves is called polarization; Polaroid material, a polarizer, performs such a control. This control is shown in Figure 1. If the "optical slots" or axes of two sheets of Polaroid film are parallel, the light passing through the first sheet with its vibrations all arranged in the same plane, will pass through the second sheet. If, however, the second sheet is turned so that its "optical slots" are at right angles to the first sheet, then no light will pass through the second sheet. This principle has been known scientifically for many years, but since a method for its use was available only in the laboratory form, it did not find the immediate and far-reaching applications that Polaroid material now offers.

Probably one of the most humanitarian applications is the field of elimination of headlight glare. In this application every automobile will have its headlights and windshield equipped with Polaroid screens, the "optical slots" or axes to be at 45 degrees to the horizontal. Then two automobiles running side by side, in the same direction, will each reinforce the other's lights, but, if one turns around and approaches the other, the "optical slots" in the viewing or windshield screens and the headlight screens are automatically crossed at 90 degrees. Under this condition very little light from the oncoming automobile headlights will reach the driver's eyes through his own viewing screen. The oncoming headlights appear as dull purple discs and the road is as visible as it was before the approaching car came into view. There is no partial or temporary blindness when passing. This particular application is not yet ready for public release, but is presently anticipated.

When we look at non-metallic surfaces the light that comes to our eyes is of two kinds: diffused light which gives us the story of the color, texture, and detail of that surface, and specular or "mirror-like" reflection, called glare. The specular reflection is made up largely, and often entirely, of vibrations parallel to the reflecting surface. In other words, the specular reflection is polarized to a greater or less degree. The diffused light is not polarized, so that by viewing the surface through a Polaroid filter it is possible to control the apparent brightness of the specular reflection without changing the relative brightness of the diffuse reflection.

Most of the surfaces from which we experience glare outdoors are relatively horizontal, such as roadways, beaches, snow, and water. In this case, the glare, or specular reflection, is either partially or completely polarized, with the wave vibrations parallel to the surface, or horizontal. Now to control the apparent bright-

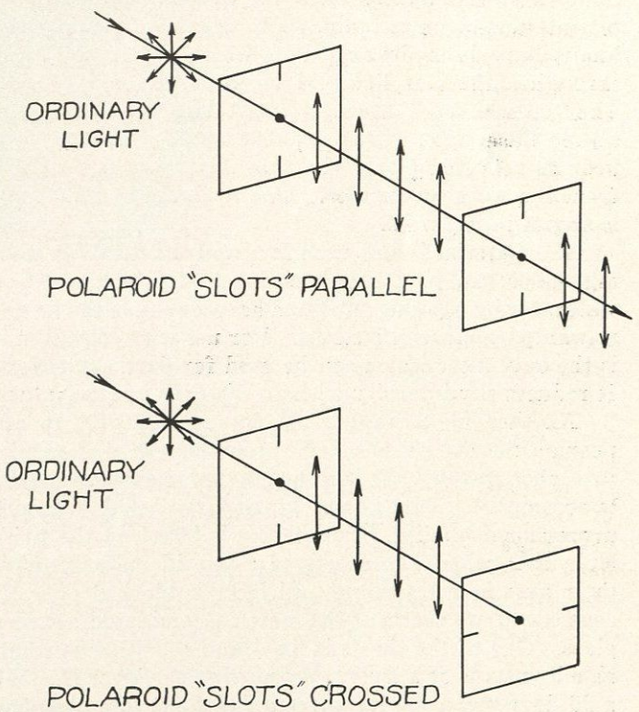


Figure 1

*Registered trade name of a material manufactured and sold under (E. H. Land) U. S. Patents 1,918,848, 11,989,371, 1,951,664, 1,956,867, 2,011,553 and others.

Figure 2—New Polaroid Desk Lamp

ness of this glare we can view the surface through a Polaroid screen with the "optical slots" approaching the vertical. This is the way Polaroid sun glasses are made. Thus they discriminate against the glare and and not the diffused or useful light.

It was reasoned that if the sun glasses discriminated against the glare outdoors, why not use them indoors under artificial light. Then the next logical step was to put glasses on a lamp, so to speak. Several desk lamps have been developed in which the light passes through a sheet of Polaroid to the work on the desk. The "optical slots" are so oriented that they trap at the source those light vibrations that would ordinarily appear as reflected glare. In this way there is no glare from the working surface. One model of a desk lamp is shown in Figure 2.

The material is also used for camera filters. A photographer can photograph obliquely through glass or water, for by rotating the filter he can subdue the bright unwanted surface reflections. For use with color film it is the only filter which can be used for dark sky effects. It reduces sky intensity without distorting color values.

Another photographic development shortly to appear on the market is a device for amateur motion picture photography. It is a device that enables amateurs to accomplish "fade" and "lap dissolve" with a smooth professional quality. The device is based on the principle that when two sheets of Polaroid material have their axes at right angles, all light is blocked out. It consists of two sheets of the material laminated between glass. One of the sheets is fixed and the other is rotatable by means of a lever. By moving the lever through a 90 degree arc, anything from full light to a complete blackout may be gradually accomplished.

This is the same principle as used for some recent Polaroid installations in train windows. In this case, the window consists of two sheets of the material mounted between glass, as in the photographic device. They differ only in size and the mechanical method of operation. The outer glass is fixed and has its axis vertical, as in a pair of sun glasses, and the inner window is rotatable by means of a small crank. Thus when the axes of the two sheets are parallel, the effect is as though the observer is wearing sun glasses; and the other extreme is a complete blackout when the sheets are at right angles to each other. This eliminates any need for window shades.

Polaroid makes possible three-dimensional, or stereoscopic, projection. In this system two pictures are projected, superimposed, on a suitable screen in polarized light. Projection is accomplished by means of a special twin projector which throws the two pictures on the screen, each through its own filter. One picture is polarized vertically and the other horizontally. Then if these superimposed pictures are viewed through suitably oriented Polaroid spectacles, each eye sees its appropriate image. Figure 3 is a diagram of this method of projection. The effect is quite astonishing; to the observer, the screen disappears and he feels he is looking through a window at real objects and people. At the New York World's Fair, one of the large automobile manufacturers used this system for the projection of a full size motion picture, some of it in color, showing the assembly of a complete automobile.

Another recent and interesting development is the Multi-View Stereoscope, which permits three-dimensional X-ray pictures to be viewed by groups of two to eight persons at a time. In this apparatus, two films are placed in illuminator boxes set at right angles to each other and fitted with Polaroid screens. A semi-transparent mirror is placed diagonally between the illuminator boxes. One illuminator screen produces vertical polarization and the other horizontal polarization. Each person looks through a pair of polarized spectacles. Looking into the semi-transparent mirror, the observer sees one image reflected in the mirror and the other through it.

(Continued on page 43)

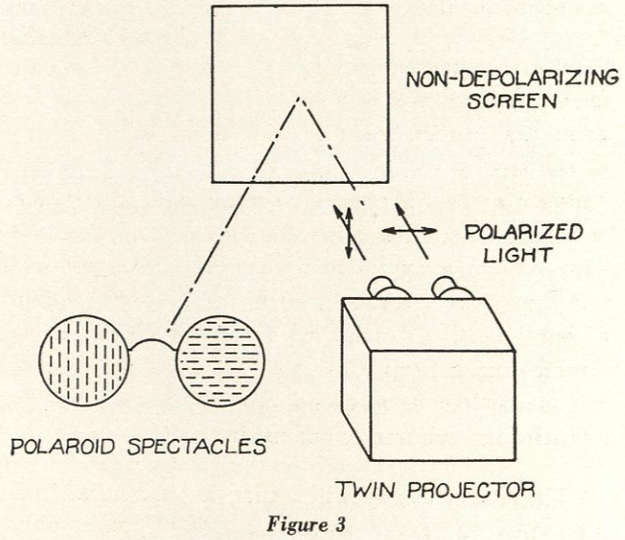


Figure 3

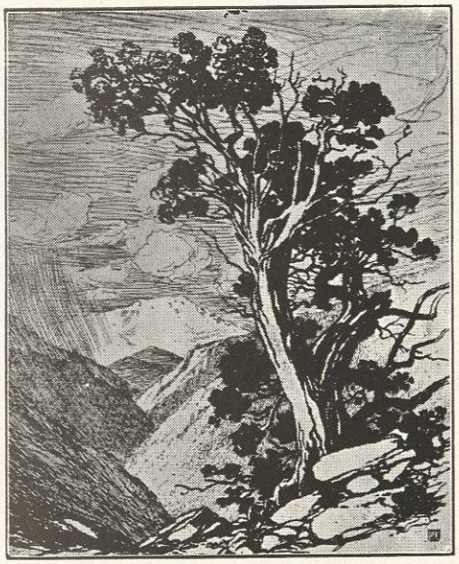
Engine Tree

THE TAU BETA PI PRIZE-WINNER

Robert B. Harris, arch, '40

ENGINEERING in the past has been small and thin and may be compared to the seed of the tree that has been planted and has put forth its first roots. Present engineering is the growth of that seed into the trunk of the tree, and it remains for the future to clothe the tree with the branches, flowers, and fruits of this great and over-all science.

Let us say the mythical tree is an oak and then we can carry the comparison further. The oak is slow in its growth and so is practical engineering. The start of the science took place as far back as 250 B. C., when Archimedes was propounding his theories, but it was not until the time of Sir Isaac Newton, and others of more recent date, that much progress was made. Developments began to increase in speed, and since the nineteenth century much has been done to educate young men in the principles that have been established. We are a part of that group of fellows, and we must make use of these rules.



We, as young engineers, must divide ourselves and form the sturdy branches of the tree of engineering. Already we have chosen the turning point in our choice of scholastic studies, but we must not stop there. We will have to continue to branch off and increase the number of twigs, which, in turn, will produce the fruits of our labors. It makes no difference which we take, Architectural, Civil, Chemical, Electrical, or Mechanical, just as long as we do not blind ourselves to the possibilities in each one of the fields.

The Architecturals will realize that more than buildings must be made attractive. Ships, automobiles, bridges, and many other things must be designed, too. In the Civil's eye we shall see dams, canals, railroads, highways, buildings, and so on, all presenting points of specialization while still remaining on the Civil Engineering branch. Chemicals, again, shall see varying possibilities in their profession, and Electricals must choose either power or communication sides which can be broken down even to more specific positions. Mechanical Engineers are no different in principle, for we all will find some one part of engineering which we like the best.

After having settled ourselves on a branch or twig of the great "Engine Tree," we must in the future form a blossom. Small though our work may be, it will form that blossom; and its size will vary, not on the size of the project, but on the thought, plan, and common good behind it. We, as future engineers, must keep our minds above the men of the past and present in order that we may further the science and cause the twig of ours to bear fruit.

We cannot all hope to become great men and discover some profound principle, but we can all let our little flower of work become a fruit in the eyes of those who are not able to understand. If we try our best to make the world better by our help and our work in engineering, we shall succeed, in part at least, in this task.

The work of the Engineer is never done, and as the tree blooms each year, so must we continue to strive for the best and try to increase this growth of knowledge which we have had given us by the past, or roots, and the present, or trunk, into something great and worth while in the future.

Head Men

Robert Raymond Lang
President, Combined Engineers

ROBERT RAYMOND LANG, senior electrical engineer and president of the Combined Engineers, first graced the world in Denver on March 16, 1918.

In high school, Bob's main interest was in science, but in college his attention seems to have wandered. He likes laboratory courses, dislikes physics courses, thinks Freshman Lectures are a waste of time, and would like to see occasional all-engineer convocations at Macky substituted for them. He thinks Colorado has the best electrical engineering school in the country, and came here from trust in that opinion. Last year General Electric noticed his 2.96 average, found the man behind it, and as a result Bob will join the ranks of Test Men when he graduates this June.

His impressive list of activities follows: president of Sigma Phi Epsilon social fraternity, vice-president of Sigma Tau, secretary of Heart and Dagger, and member of Tau Beta Pi, Sumalia, and Eta Kappa Nu. He also was winner of the 1937 Tau Beta Pi freshman award.

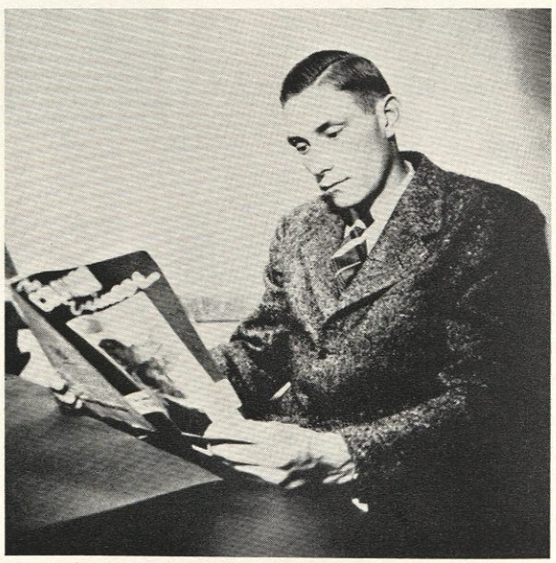
ONE case that wasn't taken to Justice Bock of the State Supreme Court, was the one carried by the stork which brought PAUL KENNETH BOCK to Denver on August 26, 1918.

Paul, president of the student branch of the American Society of Civil Engineers, secretary of Chi Epsilon, and member of Tau Beta Pi and Sigma Tau, admits an early interest in science starting at North High School, Denver. However, he once thought he might be a physicist, then came to the saving grace of chemical engineering until a freshman chemistry final turned his decision to civil engineering. He served on this year's Apple Fest committee, and last year's Engineers' Day committee, managing so far to maintain a 2.5 average.

Paul Kenneth Bock
President, A. S. C. E. Student Branch

He had opportunity to engage in some practical work when he joined the survey crew of the Denver and Rio Grande Western Railroad during the summer of 1937 observing some "interesting and instructive" construction work. In common with President Roosevelt, besides being a Democrat, Paul is a stamp collector.

THE City of Golden, Colorado (also noted for a brewery) became responsible for ROBERT FRANKLIN MAUGHAN on May 5, 1919. Bob came to Boulder from that city to "go to college instead of to school," and since his advent has really "gone," too. Holder of a

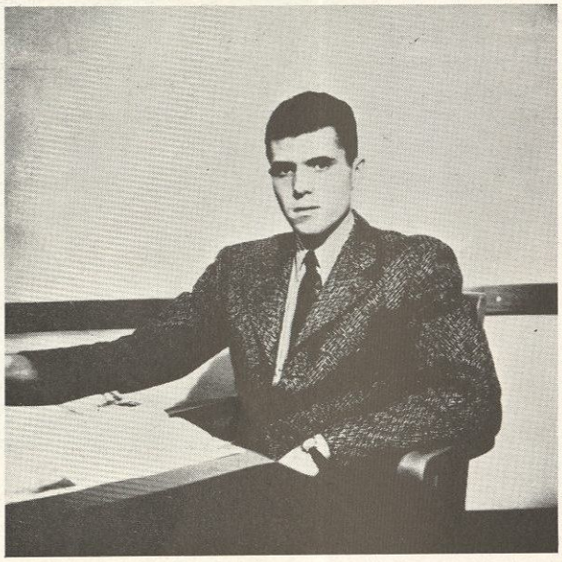


Robert Franklin Maughan
President, A. I. Ch. E. Student Branch

2.5 scholastic average thus far, Bob is president of the student branch of the American Institute of Chemical Engineers, one of the organizers of the American Chemical Society on this campus, and holds membership in Tau Beta Pi, Scimitar, Alpha Chi Sigma, and Sigma Tau. He is also vice-president of Sigma Phi Epsilon social fraternity, and an all-intramural man in touchball, basketball, and softball. Apart from these school activities, Bob's interests embrace hunting, fishing, and women. Asked for a few opinions, the genial Mr. Maughan gave forth as follows: "The main trouble with college is that there are so many things to do and so little time in which to do them.

"The trouble with the engine school is that there isn't time enough for cultural courses; engineering should take the student five years to complete." Bob also thinks that all students having a "B" average should be exempted from finals. He intends to enter the field of Industrial Hygiene after graduation.

For the second of a group of features exploring and presenting interesting personalities of the engineering school, we have chosen to present the presidents of the four student branches of the national engineering societies, and the president of the Combined Engineers. By this choice we think a fair cross-section of the many personal interests of representative members of the several branches of engineering is exposed. After all, though marked by the title of president, they are humans and fellow student engineers.



Raymond Duane Wright
President, A. I. E. E. Student Brnach

BORN in Kansas in 1917, RAYMOND DUANE WRIGHT attended school in a number of places in Utah and Colorado. As music has always been one of his favorite interests, he played in the band in high school. His talents extended to other fields as well, as evidenced by a medal won at oratory and membership in the National Honor Society. He attended Colorado University for his freshman year, stayed out of school a year, then came back to continue his electrical engineering course. He is president of the student branch of the American Institute of Electrical Engineers, and a member of Pi Mu Epsilon. Incidentally, Ray wants it known that he is a power engineer and not a "radio amateur."

During his summers, Ray has pursued many occupations, threshing wheat in Kansas one summer, working at a dude ranch another, and splitting several summers between working for the railroad on a bridge gang and Marine Reserve training at San Diego. His main hobbies are military affairs and music, with the latter predominating. He is a past master at naming orchestras and singers from their theme songs and style of singing or playing, and has constructed an elaborate chart with this information on it.

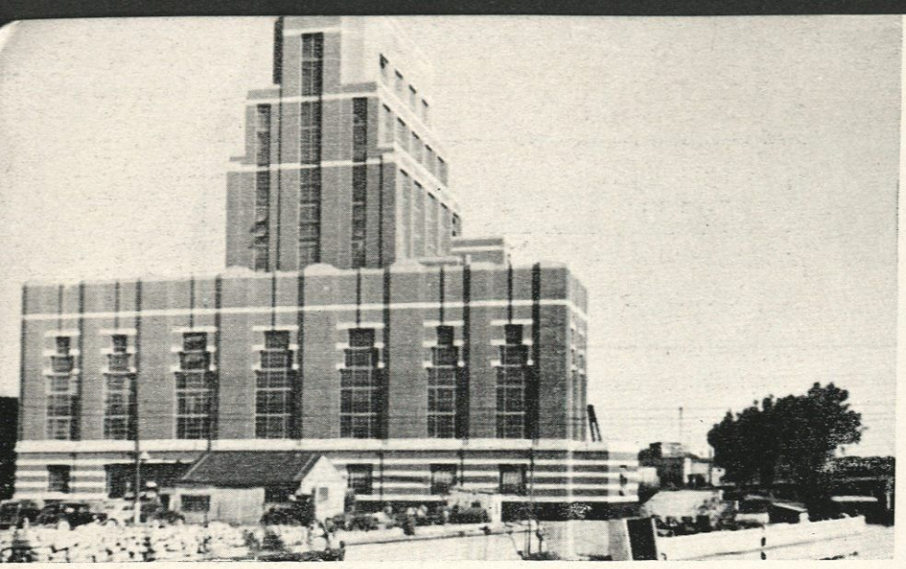
Lawrence Strite Burt
President, A. S. M. E. Student Branch

SENIOR LAWRENCE STRITE BURT, likeable personality of the engine school, was born May 5, 1918, up Boulder Canyon. In addition to being president of the student branch of the American Society of Mechanical Engineers, this local boy became a member of Pi Tau Sigma, assistant editor of THE COLORADO ENGINEER and president of the Theta Xi social fraternity. He is one of the few who believe that THE COLORADO ENGINEER is not overstocked with assistant editors and staff assistants.

Larry's other interests include skiing, swimming, and playing the piano and organ. He was an organist at his local church and, furthermore, likes to tinker with the mechanical design of organs. He spent a large part of the early winter unsuccessfully praying for snow.

He thinks that the subject of mechanical engineering is not covered well enough in four years, although five years is too long to go to school. He has no definite plans for the summer, but is interested in practical research.

NEWS



Courtesy Power Plant Engineering

STACKLESS POWER PLANT

In Lansing, Michigan, is located the first of a new type stackless steam power electric generating plant. The building houses 35,000 K.W. of steam-electric generating equipment, yet there are no visible stacks and no gases or ash seen coming from the plant. All liquids in the gases are condensed and the ash which does not come out as molten slag is caught by means of an electrostatic precipitator placed in the stack. The stack is the same height as the rest of the building and cannot be seen.

LARGE WIN

Aviation's new impo
minded world is spurring
air research and develop
usual equipment in great
National Advisory Comm
its Langley Field research
wind tunnel where forc
planes are studied. The
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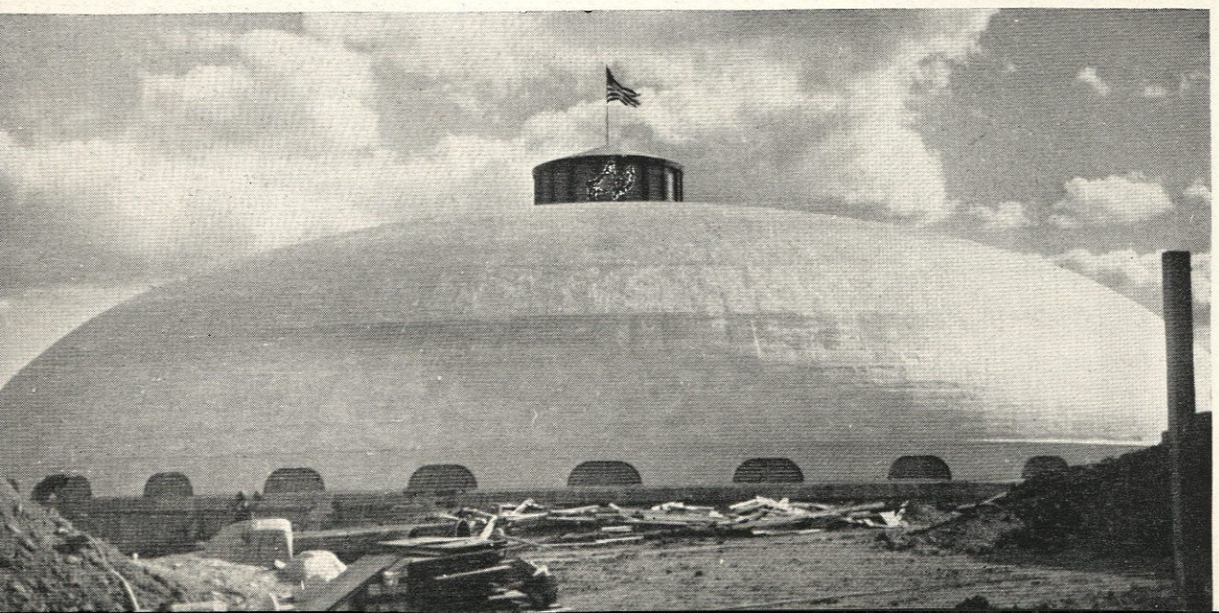
ing a 120-mile-per-hour w
study of the air forces
speeds of various types
much as 35 miles per hou

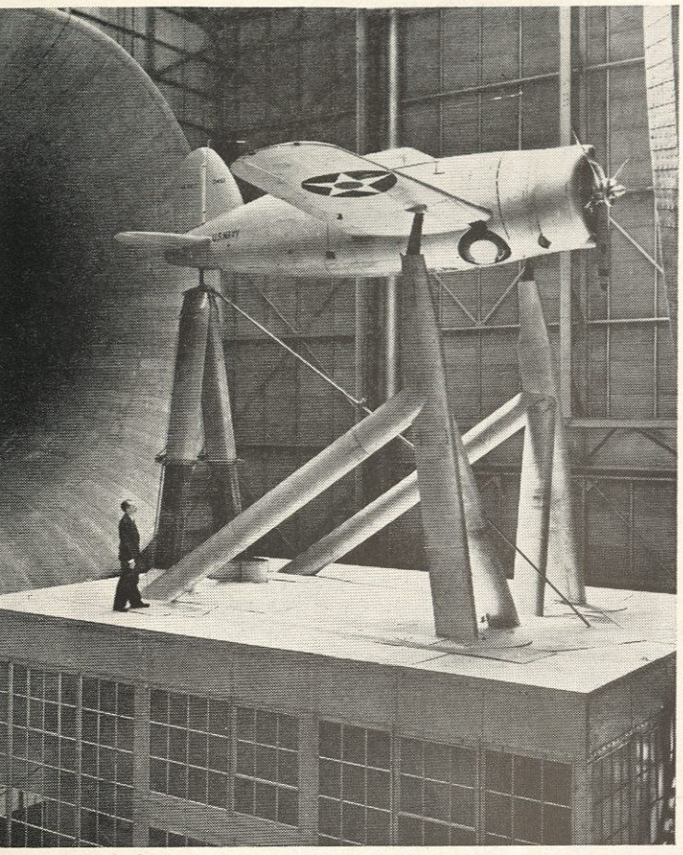
ELLIPTICAL CONCRETE DOMES

Two huge concrete domes, elliptical in shape, were constructed to protect the trickling filters of the new sewage disposal plant at Hibbing, Minn., from the extreme cold of the region. The base of each is 150 feet in diameter, while the structure is 32 feet high. The shell varies from 3½ to 6 inches in thickness and is reinforced with four layers of ring steel. An elliptical shape was chosen for economy and flexibility.

Courtesy Engineering News-Record



BRIEFS



Courtesy Steel

D TUNNEL

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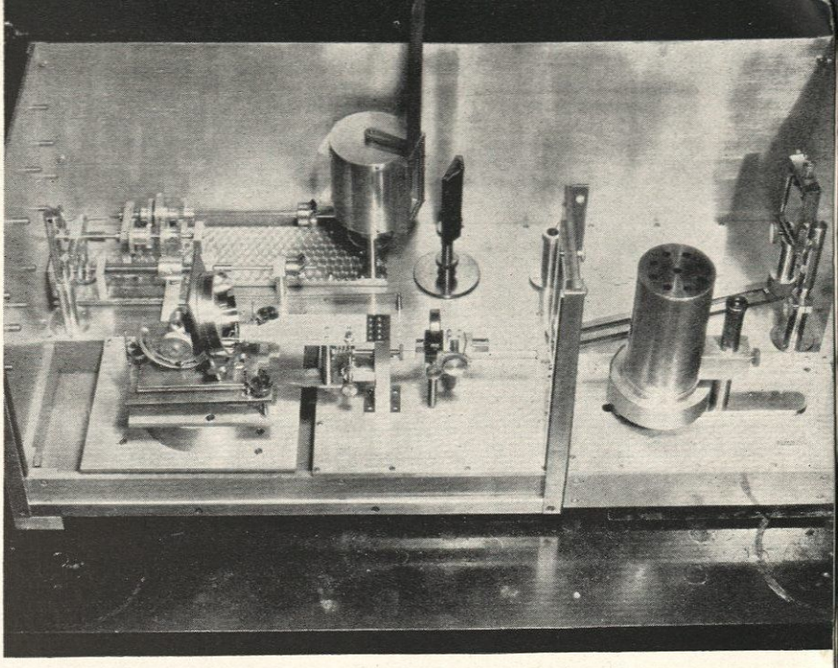


Courtesy Steel

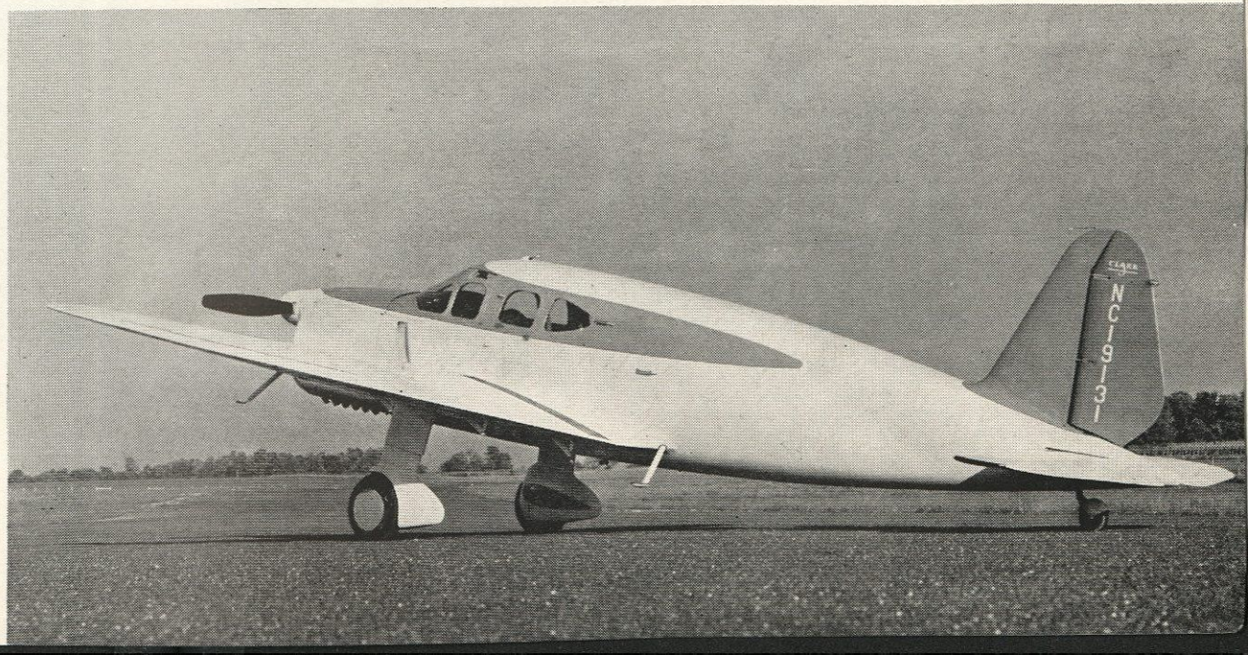
SPLIT-HAIR MEASUREMENTS

Importance now attached to the surface quality of precision parts produced commercially in quantities, is emphasized by this "profilograph," shown in the process of testing a finish on an inner race of a tapered roller bearing. Through a delicate system of levers and mirrors, a tiny beam of light is made to indicate the degree of smoothness to millionths of an inch.

THE "PLASTIC" AIRPLANE

The fuselage of the new "plastic" airplane is made of "Duramold," a secret composition which is not a plastic in the true sense of the word. One half of the entire fuselage can be moulded in a single operation, and then the two parts cemented together. The external smoothness of Duramold ships makes it possible to attain a given high speed with 25% less power than the all-steel models require. Duramold does not burn.

Courtesy Mechanical Engineering



CAMPUS NEWS

NEW LIBRARY

COLORADO UNIVERSITY'S new library was opened on the first day of the winter quarter. The library has cost $540,000 and has been under construction for the last eighteen months. The library has been under the observation of universities all over the country because of its revolutionary facilities.

The new building was designed by Charles Z. Klauder of Philadelphia, who was the architect for all new buildings on the campus before his death last November. Temple Buell, a Denver architect, was associated with Klauder.

Forty-five per cent of the cost of the building was a grant from the PWA and the rest was raised by a bond issue which will be repaid from the building mill levy during the next two years.

The most outstanding feature of the new library is its division into four separate units. In the four large reading rooms the books for that division will be arranged by call number on the shelves around the room. All books are on open shelves and any student is free to select his own books.

In addition to the four division reading rooms there will be separate rooms for the rare book collection, the historical research collection, the extension division, the reference and bibliography library, films, the document collection, studies, seminars, the music room, and the browsing room.

The browsing room will be particularly attractive to students as new books and the honors collection will be on open shelves in this room. The browsing room will also serve as a lounge and a smoker.

There will also be typing rooms at the end of the social science and humanities libraries. A book lift in the stack room is another convenience. Fluorescent lighting will make reading easier in the new building. Dr. Ralph E. Ellsworth will remain as director of the libraries.

The old library, which has been used as such since its construction in 1902, will be remodeled into a Little Theater.

ENGINEERS' BALL

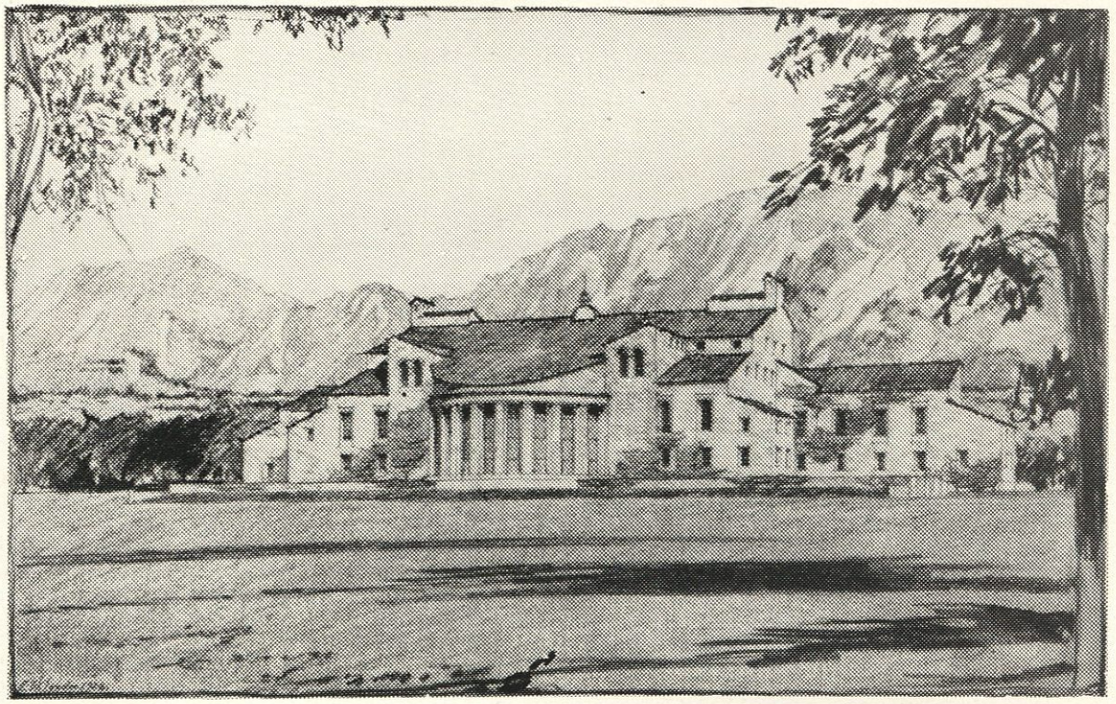
Harold Davis was named chairman of the Engineers' Ball Committee, with Thomas Dalby, John Hodge, John Immel, Bob Lunn, Ted Reed, and Robert Rosenkrans making up the rest of the committee. The committee was chosen December 7 by the four officers of the Combined Engineers. An equal number of students was chosen from each branch of the engineering college. It has not yet been decided whether to have the ball during the last part of winter quarter or the early part of spring quarter.

SENIORS GET JOBS

The General Electric company awarded contracts to eight senior engineers November 23 for positions with the company. The men, all of whom had a 2.1 average or better, were selected by M. M. Boring, personnel director of General Electric, after personal interviews.

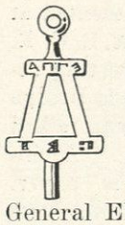
Mechanical engineers receiving contracts were Ben Fisher, Robert Johnson, Harry Mayor and Edward Naylor. Electrical engineers were Floyd Busch, Robert Lang, Billy Shepard and Francis Stevens. The men will report to the company offices between June and December of 1940 to begin their year's training course.

The Westinghouse Electrical Company and many other companies will have representatives on the campus before the end of the school year.



Colorado's New Library

TAU BETA PI



Tau Beta Pi held formal initiation for 18 men on the evening of November 20. Following the initiation all the members were entertained at a banquet held in the Memorial Gold Room. Papers written by the pledges were read and judged. The speaker of the evening was Mr. M. M. Boring of the General Electric Company. Mr. Boring spoke on the future possibilities of engineering.

SIGMA TAU

Twenty-one men were initiated formally by Sigma Tau on the evening of November 27, following an earlier mock initiation. A banquet in the Memorial Gold Room followed the formal ceremonies. The speaker of the evening was Mr. C. W. Keller from the General Electric Company. Mr. Keller showed some very interesting motion pictures in technicolor taken by him during his recent trip through Europe.

CHI EPSILON

Chi Epsilon held a banquet and formal and informal initiation at Blanchard's Lodge on the evening of November 26.

The welcome to initiates was given by Thomas E. Dalby, president of Chi Epsilon, and the response was given by Clara M. Barnes. Professor of Civil Engineering Warren Raeder also addressed the initiates. A special alumni guest was Mrs. W. H. Taylor (Marian Barnes), who was the first woman to become a member of the fraternity. Her sister, Clara Barnes, became the second when she was initiated at the banquet.

Those initiated were Clara M. Barnes, Leslie A. Clayton, Abe Emeson, Oscar B. Jacobson, Mahmood K. Taher, John D. Brawner, Charles Conrado, William J. Drescher, Samuel W. Tammingo, and R. James A. Thomson. The faculty of the civil engineering department was also present.

At previous meetings of Chi Epsilon the pledges were instructed about the rules of the fraternity and committees were appointed to take care of the necessary preparations for the initiation and banquet.

ALPHA CHI SIGMA

At a meeting on November 22, Alpha Chi Sigma, professional chemical fraternity, placed pledge ribbons on the following men: Earle Devalon, Tom Gurmatakis, Edward Meikel, John Bartram, LeNaire Eckman, Rollin McCombs, Doran Smith, and Hal Harrison.

ETA KAPPA NU

Eta Kappa Nu, honorary electrical engineering fraternity, initiated nine pledges before a banquet at the Gold Room in Memorial building on November 21.

The new members are Warren Mallory, Werth Hage, Donald Littlejohn, Irving Zambakian, Howard Piper, Albert Gregg, Herbert Conn, Stanley Fitzmorris, and Ted Reed.

M. M. Boring, personnel manager of the General Electric Company, was the speaker at the banquet, and C. M. McCormick, assistant professor of electrical engineering, was toastmaster.

PI TAU SIGMA

On November 14, Pi Tau Sigma held formal initiation at the Boulderado Hotel for Lawrence Burt, John Cuming, Maurice Petersen, Melvin Schuster, Carroll Stoecker and Maynard Warneke. The formal ceremonies were preceded by a mock initiation and followed by a banquet at which papers written by the pledges were read. The prize-winning paper was written by Maynard Warneke.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The A. I. Ch. E. held a banquet on November 15, in the Gold Room in Memorial building. The speaker of the evening was Dr. John Cummings, who is doing research work on public hygiene at the Colorado University School of Medicine.

At a social meeting on November 22, the members of the A. I. Ch. E. played cards and enjoyed cider and doughnuts for refreshments.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Mr. A. S. Anderson of the General Electric Company was the speaker at the January 10 meeting of the A. I. E. E. The subject of his talk was the Spira-Core Transformer.

At the January 24 meeting of the A. I. E. E. Mr. Wade Taylor and Mr. Newell Parker, both of the Bureau of Reclamation, will address the society on timely electrical engineering topics.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

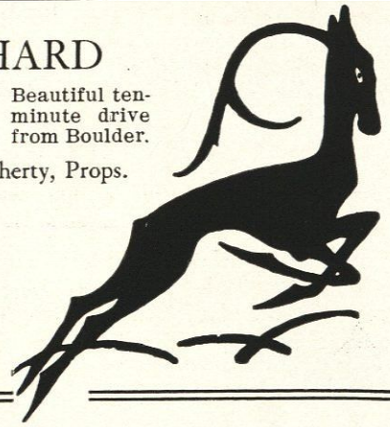
The main speaker at the last meeting of the A. S. M. E. in the fall quarter was Professor DeMuth of the Colorado University Law School. Professor DeMuth gave an interesting discussion on patents. The evening was topped off with refreshments consisting of cider and doughnuts.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Papers by students were presented at the November 8 meeting of the A. S. C. E. Thomas E. Dalby gave an interesting account of the building of the Eads Bridge of St. Louis. Joseph H. Freedman talked on the developments of the housing problem. "Archimedes" was the subject of Robert B. Harris' paper. The maintenance problems in the Moffat Tunnel were given by R. James A. Thomson as the closing paper of the evening.

The November 22 meeting of the A. S. C. E. featured additional papers by students. Clara M. Barnes spoke on "The Developments and Possibilities of Prefabrication in the Building Industry." "John A. and Washington A. Roebling" was the subject of Douglas E. Drier's paper. Hugo B. Follum spoke on "Industrial Designs by Albert Kahn." Robert E. Scherrer completed the evening's program with a paper on "The Grand Coulee Dam Project."

Paul K. Bock opened the January 3 meeting of the A. S. C. E. with a paper on "Highway Safety." "Thousand Island Bridge" was the subject of Sidney E. Dinner's paper. Joseph L. Jones talked on "The Failure of the St. Francis Dam." Theodore D. Petersen's paper on "Recent Developments in the Use of Concrete in the Architectural Field" completed the program.



ALUMNEWS

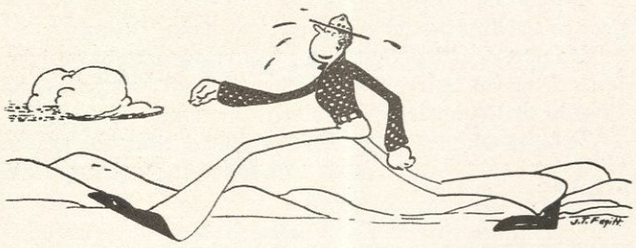
1907

A. Camp Streamer, e, has been appointed general manager of the East Pittsburgh division of the Westinghouse Electric and Manufacturing Company. Formerly, he was manager of the switchgear division of the company.

1914

Ephraim B. Wilkinson, c, is a member of the firm of Wilson, Wessner, Wilkinson Company of Knoxville, Tennessee.

Howard P. Bunger, c, has left the United States Bureau of Reclamation to accept a position as senior engineer with the special engineering division on the new work being done on the Panama Canal. His headquarters are at Balboa Heights, Canal Zone.

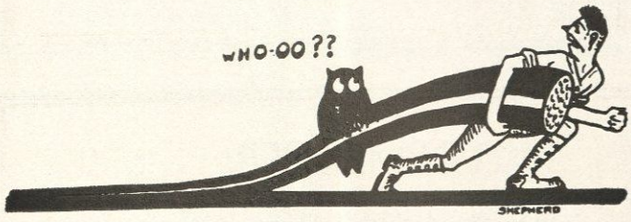


1916

Maynard M. Boring, e, personnel director for the General Electric Company, visited the campus recently to select seniors who will be employed by that company after graduation. While here, he spoke before Eta Kappa Nu and Tau Beta Pi.

1921

Captain John Harry, c, formerly stationed with the coast artillery in the Philippines, has been transferred to Fort Rosecrans, California.



1925

William D. Johnson, e, is inspector in charge of the Puerto Rico and Virgin Islands district for the Federal Communications Commission with offices in San Juan, Puerto Rico. Supervision over all communications matters involving the United States Government in this district is carried on from this office.

1926

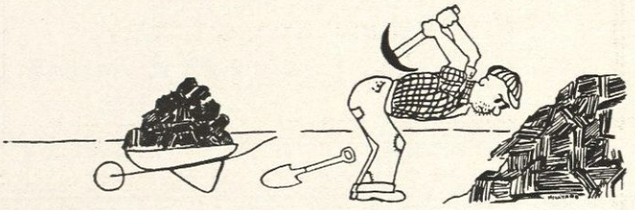
Edward M. Paullin, Jr., e, an employee of the Worthington Pump and Machinery Corporation's Buffalo Works, is assistant manager of the compressor division and has been granted several patents in the name of the company on devices relating to this field.

1928

Frank M. Starr, e, who is a member of the central station engineering staff of the General Electric Company, Schenectady, New York, has written a paper on "Secondary Versus Primary Capacitors," which was published in *Electrical Engineering*. Starr visited the campus recently on a flying trip from the west coast to Schenectady.

1930

Harry S. Deines, m, has been appointed publicity representative for the General Electric Company's New York district. He is also editor of the *Civic Players Magazine* and a co-founder of the Schenectady Aviation Club.

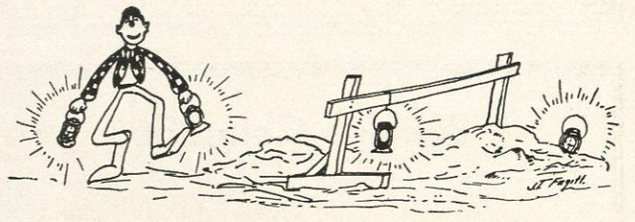


Adolph Q. Lundquist, m, is manager of the North Continent Mines at Montrose, Colorado.

1931

Anthony W. Jones, e, has transferred from the United States Geological Survey to the Bureau of Public Roads, Denver, Colorado.

Richard T. Montgomery, m, who lives at 1075 North Second Street, Raton, New Mexico, has been appointed city engineer of Raton.



David M. Beach, c, is employed by the Public Roads Administration under the Federal Works Agency.

1933

Arthur De Backer, m, is now sales engineer for the Gates Rubber Company, with offices in Omaha, Nebraska.

1935

JAMES J. NEWMAN, e, is employed by the Olson Manufacturing Company of Boise, Idaho, as an engineer in the construction of the longest non-supported span of pipe in the world over the Shoshone River west of Cody, Wyoming.

1937

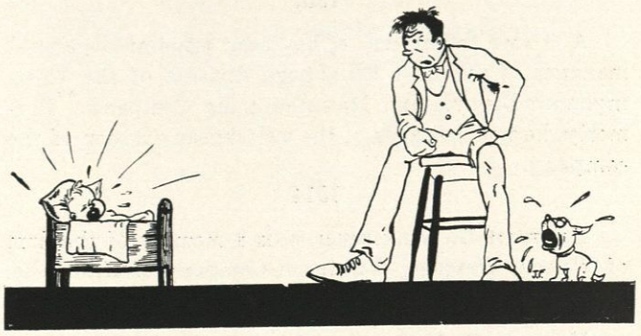
JOSEPH LEWIS, m, is working for the Lockheed Airplane Company at Burbank, California.

ELSTON GARDNER, m, is employed by the Douglas Aircraft Company at Santa Monica, California.

ARNOLD M. JUDD, e, who has been working on his Master's degree at the University of Illinois, has accepted a position in the United States Engineer's office at Louisville, Kentucky.

1938

RAYMOND W. RUSS, e, is a federal engineer examiner at Fort Worth, Texas.



MELVIN E. CLARK, ch, and Mrs. Clark, who are residing at 951 Edgewater Avenue, Ridgefield, New Jersey, announce the birth of a son, John Robert. Clark, a former editor of THE COLORADO ENGINEER, is on the editorial staff of the *Chemical and Metallurgical Journal.*

ROBERT M. MAINS, e, is working on his Master's degree at the University of Illinois, Urbana, Illinois.

ROBERT L. HALLOWAY, m, has resigned his position with Douglas Aircraft to accept a job with Curtiss-Wright of Rochester, New York.

ROBERT MUNDHENK, m, and Carol Gordon, m, are with the Lockheed Airplane Company at Burbank, California.

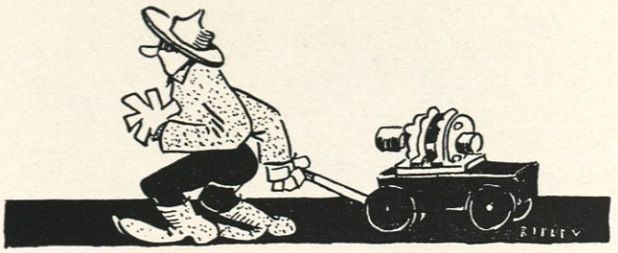
ROBERT J. ROMANS, e, is making a trip up the Amazon from Rio de Janeiro as a part of his travels in South America.

1939

WILBUR E. BICKEL, m, is now the engineer in charge of water and coal service for the Denver and Rio Grande Western Railroad.

LELAND PARRISH, m, has accepted a position with the Civil Service as junior mechanical engineer, materials division, at Dayton, Ohio.

JOHN J. BROSIUS, m, an employee of the Public Service Company, is working at the Valmont plant.



HOWARD M. PERRY, e, is employed by the General Electric Company, Erie, Pennsylvania.

GEORGE S. BRANDT, c, is an employee of the New York State Electric and Gas Corporation, Oneonta, New York.

ARTHUR WILLIAMSON, c, senior engineer for the United States Bureau of Public Roads, is working in the bureau office at Denver, Colorado.

The Eyes Have It

(Continued from page 30)

Another recent development is the Polaroid Dermascope. With this device it is possible to look through the outer surface of the human skin. Until now it has been often quite impossible to obtain a precise view of lower layers of the human skin because of the bright surface reflection which acts as a shiny mask. Now by controlling the pattern of the light vibrations, we can control the behavior of the reflection, accentuating or eliminating it at will. This is the first of a series of examination and inspection devices to be brought into practical use. Those now being developed include instruments specially designed for use by dermatologists, ophthalmologists, dentists, other medical specialists, criminal investigators, and art experts.

Polaroid has a very definite function in the field of strain testing or photo-elasticity. Ordinary transparent materials, such as glass and transparent plastics, transmit light in any direction without altering its character or its polarization. Such materials are "isotropic," meaning they are not doubly-refracting. However, when these materials are strained they become "anisotropic," or doubly-refracting. The degree to which they become doubly-refracting depends on the intensity of the strain. In engineering, a model is made in celluloid of a structural shape and subjected to strain in a polarized field. Strains appear in the specimen as light and dark bands, and from calculations of this strain pattern, the behavior of the full-sized metal parts in service can be determined.

In the glass container industry, the analysis is usually only qualitative. The industry has evolved simple breakage tests by means of thermal and mechanical shocks. Their procedure is somewhat as follows: First a bottle is observed in a polariscope and the strain pattern observed; then the bottle is subjected to the usual shock tests and its behavior noted. A correlation is then established. By doing this for a number of bottles of a given type it is simple to establish what kinds of strain patterns are good and which are bad.

Another field which holds great promise is that of color display for advertising, architectural effects and theatrical uses. When a film of transparent cellophane is placed between two sheets of Polaroid in front of a white light, brilliant colors appear in the cellophane film. These colors are created by the withdrawal of certain spectral components of white light by the interference of light vibrations occurring at the second sheet of Polaroid. The colors may be changed by using different thicknesses of cellophane film, by rotating either Polaroid sheet or by changing the point of view. In its simplest form an advertising display is made of a Polaroid-cellophane-Polaroid sandwich placed in front of a light source. The cellophane is cut to the proper design and successive layers are added to obtain desired color.

These applications, which have been described very briefly, present an almost limitless field for development. Just what the future holds for this material and its ability to control light, we are unable to prophesy, but already the laboratory has innumerable applications listed.

OIL CAN

THE HONORARY SOCIETY OF LUBRICATION ENGINEERING

Lubricity shall lack no champion . . .
Friction shall not thrive unopposed

WA-AL, final week is over. You remember final week—those disconcerting few days at the end of last quarter which we all thought were a lot of trouble, but which seem incidental in comparison to the trouble caused by having to come back to school so soon after New Year's Eve. But now, thoughts of finals having left us (since about 10:30 P. M. of aforementioned Eve), all of us are ready to be poured into a new quarter with many fine resolutions to lead us on to greater things and stuff; we will all work as we have never worked before (this statement will take care of all possibilities). And the Oil Can is ready to pour a few drops to lubricate our wits, lest we forget too soon about dear old 1939. So Happy New Year!

Could be you've heard the latest about Prof. Mallory, who was discussing the properties of combustion at the Valmont plant. He explained very precisely that in this process the "stoke goes up the smack," to which a senior quickly replied, "Yes, but what's the use of having the stoke go up the smack when the stoke isn't even black?"

Another variation to this same theme has been discovered. Prof. Borgmann, in one of his chemical engineering classes, recently said, "The stasses go up the gack." It's hetting to be a gabit, I guess. I personally recommend the Mother Goose Tongue Twisters to all professors having deaking spifficulties.

Karl Warren, when told in his freshman comp class to write a theme on "The Most Important Organization on the Campus," very meekly asked whether that included the faculty or not.

"Red" Skeen, being awakened from a deep slumber in English class, had the presence of mind to tell the prof that the phrase in question was "one of those things that you were talking about." "Pressure-Volume" Thompson decided that "Red" should get full credit (off) for that brilliant statement.

Bill Drescher, Colorado University's gift to the glass industry, has acquired the habit of placing windows in parapet walls (blank or false walls around roofs to you, freshmen). I suppose that this is an innovation introduced to the building business so that the layman may easily count the number of chimneys and skylights coming out of the roof.

Teacher: "Stanley, when you were studying chemistry you no doubt learned a considerable amount concerning the oxides. Now, could you tell me what kind of an oxide leather is?"

Stanley Perry: "Well, teach, as far as I know, leather could be either an ox-hide or a cow-hide!" (Ouch!)

LANDMARKS IN ENGINEERING

Macky Honor System: students three seats apart and three rows apart—two instructors for each student . . . overheard in soph physics lab: "Which is more accurate, the thermometer or the vernier?" . . . Jim Glass' day-dreaming in Heat Treatment of Steel . . . "In-the-mood" Hungerford tootin' a terrific trumpet at Canon . . . on freshman chem quiz: If you double the concentration, the molecules push each other harder (Hey, quit dat shovin') . . . Bob Lunn in an overcoat on the balmy fall day that the A. I. Chem. E. picture was taken (Why? because he lost his pants during an unfortunate incident in ye olde Colorado Engineer office shortly before) . . . those autographed cords of Jim Fenex—there's still space on the cuffs for anyone who has failed to sign up . . . Hal Lawler's definition of "potable" water as being polluted and unsanitary water . . . some philosophy by Richard Stwalley: soft soap is 90% lye . . . Carl Ray's surprising amount of knowledge, as displayed in the last Chips colyum, concerning low necklines and points in general in women's fashions (what's her name, Carl?).

On a machine design quiz it was asked to define a multiple-part bearing. Bob Van Note gave the following definition: "By use of a multiple-part bearing, a person may be taken apart and adjusted without much work."

Dad burn it! We can't seem to keep these professors out of the colyum. I guess they make brighter-dumber remarks than the students, so I'll just have to cut you in on a few of them. For example, here are some choice drips from the lectures of Prof. Beattie:

"When steam pressure gets too high, it's best to leave under your own power, because you will be leaving pretty quick anyhow!"

"A warning whistle on a steam boiler is likely to be mistaken for the dinner whistle, and the engineer will probably start eating his lunch."

Incidentally, we think the editor should get a gold-plated oil can for his recent faux pas in Denver, don't you?

G-E Campus News

EXTRA-SPECIAL DELIVERY

TO most people, the mailman is a fellow who rings the doorbell or toots a whistle or stops at roadside boxes. But to Rear Admiral Byrd and his expedition the mailman is a chap thousands of miles away.

The Admiral's mail, you see, is delivered by one of General Electric's world-famous short-wave stations at Schenectady, just as was done for the two previous Byrd expeditions. The letters are read from WGEO every other Friday, 11 to 11:45 p.m., EST, under the direction of station manager Eugene S. Darlington, Oregon State ex-Test man, and John R. Sheehan, Union '25, program manager.

A General Electric all-wave receiver on both the *Bear of Oakland* and the *North Star*, the party's ships, are the actual mailboxes. They will later be installed at the expedition's two camps. WGEO's mailman invites friends and relatives to send messages to the Byrd Antarctic Mailbag, General Electric, Schenectady, N. Y., for transmission to the expedition. Fifty words is the maximum.

PRIZE PACKAGE

FAME is nothing new to Brazil. She is not only the world's leading coffee grower, but also the largest state in South America, being 250,000 square miles bigger than continental United States.

Fame also is nothing new to General Electric's transportation department, headed by Guy W. Wilson, Penn State '23 and ex-Test man. In all parts of the nation, the products of this G-E division can be seen in operation. Therefore, what is more natural than for these two parties to get together? They have—frequently. Their latest bit of co-operation is represented by four G-E direct-current locomotives, the world's most powerful, scheduled for delivery this month to the Paulista Railroad in Brazil. These 185-ton locomotives have a continuous rating of 4200 horsepower and a maximum speed of 93 miles per hour.

NAUTICAL MOTOR

DIFFERENT though the sailing ships of a century ago were from the express liners of today, the two have many things in common. Among their points of similarity is a need for emergency pumps, for water may sometime get where it doesn't belong because of a collision or other accident.

A far cry from the hand-operated pumps of old is the equipment which will be part of the S. S. *America*, the United States Lines' new 723-foot superliner, the largest ever built in American yards. Mounted 80 feet below the liner's boat deck, a G-E 40-horsepower motor will drive an Aldrich pump capable of emptying 900 gallons of flood water per minute. The motor and pump will empty all compartments through a system of piping reaching all parts of the ship. Other G-E equipment on the *America* includes 150 auxiliary motors and controls for such equipment as winches, refrigeration machines, and steering apparatus.

These applications are typical of the thousands of uses to which General Electric motors have been successfully applied. And an important reason for this success is the vast amount of motor-test data contributed by the young engineering college graduates on the G-E Test Course.

GENERAL ELECTRIC

90-209C