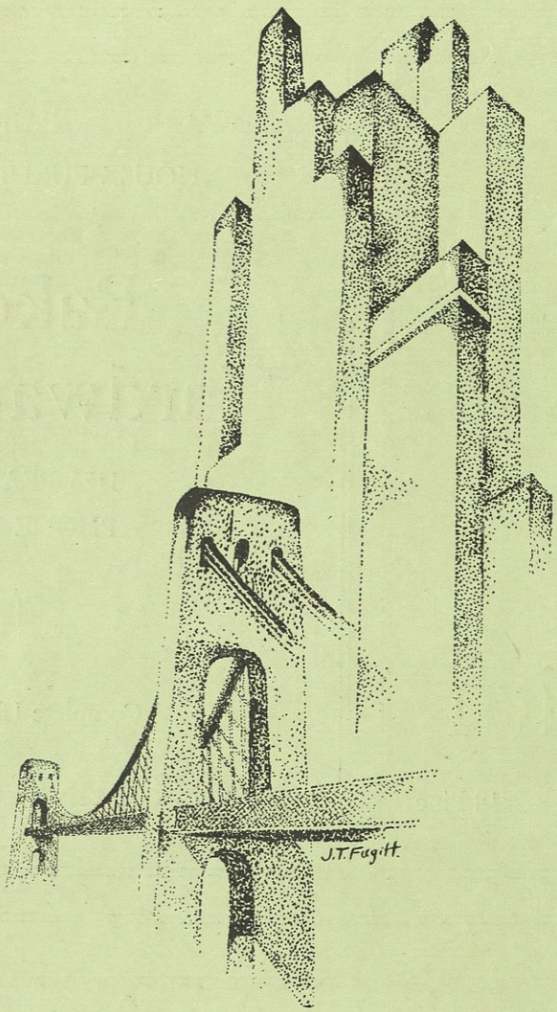
The COLORADO ENGINEER



MEMBER OF ENGINEERING
COLLEGE MAGAZINES ASSOCIATED

UNIVERSITY OF
COLORADO
MAY . . 1934

THE COLORADO ENGINEER

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MAY, 1934

Engineering College Magazines Associated

Mr. Robley Winfrey, Chairman, Iowa State College, Ames, Iowa

MEMBER MAGAZINES

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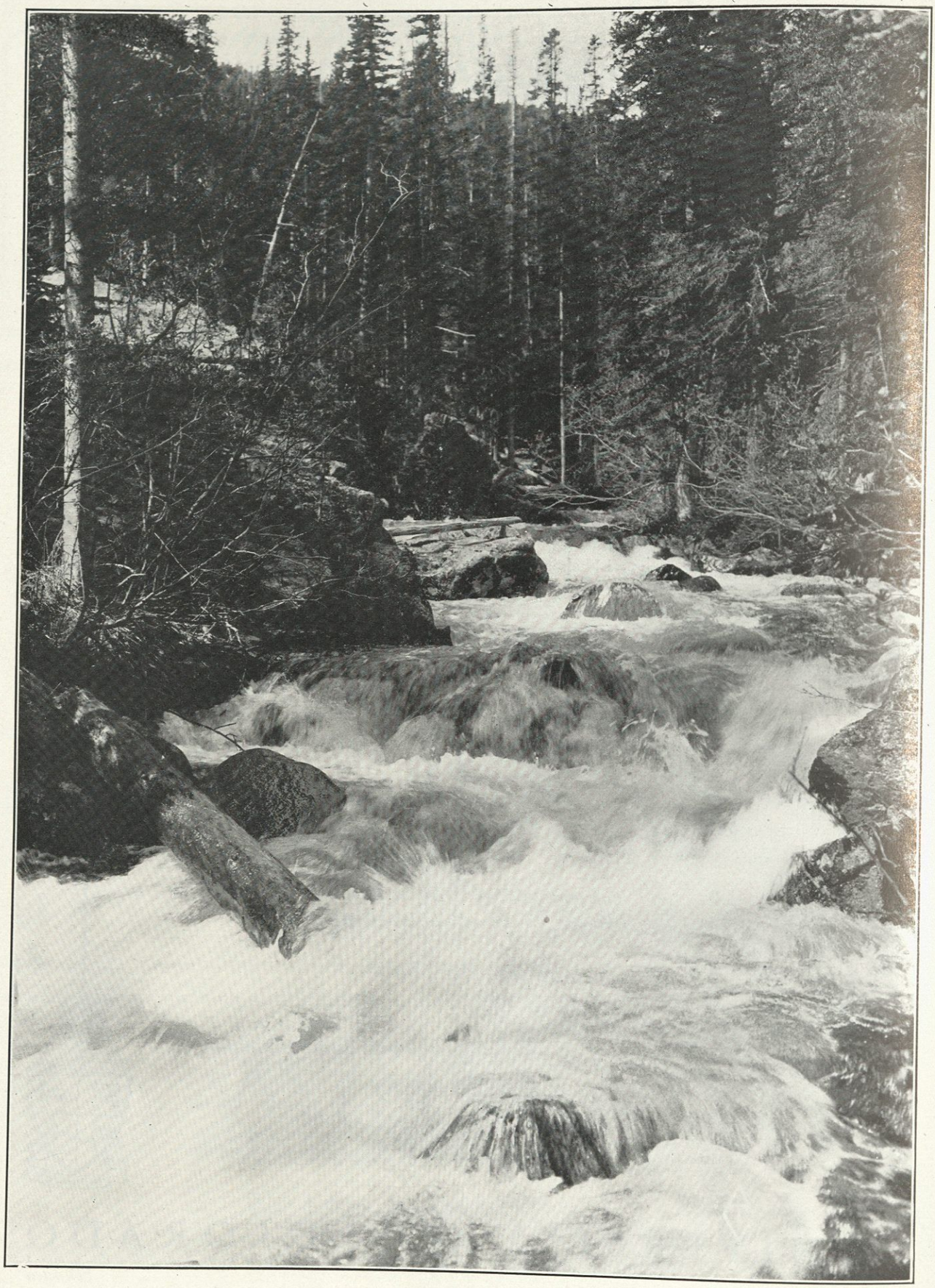
UNIVERSITY OF COLORADO

Founded
1903



Boulder Creek—A Reminder of Colorado

Thirty Years of Progress in the College of Engineering

This history, conceived originally as the COLORADO ENGINEER'S contribution to the Engineers' Day exhibit, proved of such great interest to those preparing it that the staff decided to present the history as the feature article of this, the thirtieth anniversary number. The authors of the history are Bryson Reinhardt, James Rose, David Ware, and Melvin Clark, to each of whom was assigned one-fourth of the period covered by the history.—Ed.

IN this issue we attempt to trace for you the history of the College of Engineering and that part of the history of the University which is of special interest to the College since the founding of the "Journal of Engineering" thirty years ago. It would be manifestly impossible for us to give you a detailed account of the history. We have selected merely one or two outstanding events of each year, and have assembled them in this article with the hope that these high spots will blend together to give you a vivid, lifelike picture of our College during these "Thirty Years of Progress."

1904-'05. At the instigation of Professor Milo S. Ketchum, head of the Civil Engineering Department, the first "Journal of Engineering" was published. A charter was granted to the Colorado Beta Chapter of Tau Beta Pi. The Mechanical-Chemical Society, the Civil Engineering Society, and a student branch of the American Institute of Electrical Engineers were established. John A. Hunter left the Mechanical Engineering Department of Pennsylvania State College to become Assistant Professor of Mechanical Engineering here in the fall of 1904.

1905-'07. Herbert S. Evans left the General Electric Company to become Professor of Electrical Engineering here in the fall of 1905. The Board of Regents granted an appropriation of $100,000 for a power plant and engineering shop. A new chemistry building was completed at a cost of $41,000. (This is the older, central part of the chemistry building, to which wings have been added on the east and west ends.) An attendance graph of the College of Engineering showed that the enrollment had increased from one in 1893-94 to 215 in 1906-07.

1907-'08. Engineering Building II was completed. The Sixth Annual Engineers' Ball was a greater success than ever before. The affair was strictly informal as was customary.

1908-'09. Twenty-one seniors, fifty-one juniors, and several professors took a week's inspection trip, covering 800 miles. (How do you like that, you present-day students!)

1910-'11. The University Power Plant was finally completed, and relieved the engineering building of a good deal of excess machinery. The vacated space was utilized for new laboratories.

1911-'12. Macky Auditorium was completed. The "Colorado Engineers' Magazine" was established as an undergraduate, non-technical publication. The first issue was published in March, 1912. (It was published quarterly, along with the bi-annual issue of the "Journal of Engineering" for nine years, when the two were combined, in 1921, to form the present COLORADO ENGINEER, published four times a year.) The University football team was Rocky Mountain Conference Champion by virtue of winning every game of the season.

1912-'13. An Engineers' Applefest instead of the annual Smoker was held in the Gymnasium (now the Lecture Theatre). The Ainsworth Standardizing Laboratory was moved to the University of Colorado. This laboratory was, with two exceptions—that of the U. S. Bureau of Standards and that of the General Electric Company—the most complete and up-to-date in the country. (The laboratory has since become the property of the University.)

1913-'14. Dr. James H. Baker resigned from the duties of President of the University on January 1, 1914, after serving for twenty-two years in that office. He was succeeded by Dr. Livingston Farrand. The diplomas given to the graduates of the engineering schools this year were written in English for the first time. Clarence Eckel (now head of the department of Civil Engineering), senior civil, was chosen center for the All Rocky Mountain Football Team of 1913, and was President of the A. S. U. C. this year. The engineering library was organized as a branch of the main library; now the engineers may read and study without intruding upon the feminine urbanity of the main campus library! The January, 1914, issue of the "Colorado Engineers' Magazine" carried the history of the College of Engineering by Professor H. S. Evans (excerpts). "The Colorado School of Science" was organized in the winter and spring of 1893, and courses were offered the following fall. In 1893, before the Engineering Building was erected, class and shop work were carried on in the Hale Scientific Building and Old Main. Civil and Electrical Engineering were the first departments established. In 1902 the Mechanical Engineering Department came into being, and in 1904 the Chemical Engineering Department. It was 1906 before the name was changed

to "The College of Engineering of the University of Colorado."

1914-'15. The Vulcan Society was given a charter as the Iota Chapter of Sigma Tau, honorary engineering fraternity. The Mechanical-Chemical Society was admitted as a student branch of the American Society of Mechanical Engineers. Milo S. Ketchum, dean of the College of Engineering, published his "Structural Engineers' Handbook," a book containing tables and data very useful to civil engineers.

1915-'16. The engineers started a campaign for a new gymnasium. The gymnasium (now the Lecture Theatre) then in use was too small to accommodate the crowds attending the basketball games. On April 25, President Farrand declared the first campus day, the primary purpose of which was to beautify the campus. The men planted flowers, shrubs, and trees, dug dandelions, and cleaned up the campus generally, while the coeds did their part by furnishing lunch.

1916-'17. The World War was becoming the talk of the students. The University Senate appointed a committee to investigate the various means by which the University could help the nation in case of war. The enrollment dropped off because of enlistments of students in the U. S. Army and Navy (even though war had not yet been declared by the United States).

1917-'18. The interest of the student body turned to the World War in earnest. A large portion of the men enlisted, leaving the enrollment unusually low. The remaining men took up military training and the engineers began a study of artillery warfare, explosive manufacturing, and other subjects pertaining to war. Milo S. Ketchum, Dean of the College of Engineering, was selected by the government to direct the immediate construction of a smokeless powder plant, near Charleston, West Virginia. Herbert S. Evans, professor of electrical engineering, was appointed Acting Dean in the absence of Dean Ketchum.

1918-'19. Dean Milo S. Ketchum returned from Nitro, W. Va., where he spent nearly a year in directing the construction of a mammoth smokeless powder plant. The Civil Engineering Society became a branch of the American Society of Civil Engineers. Dr. George Norlin, who had been acting president of the University of Colorado for some time in the absence of President Livingston Farrand, was made president of the University upon the resignation of the latter.

1919-'20. Dean M. S. Ketchum went to the Civil Engineering department of the University of Pennsylvania. He was succeeded as Dean of the College of Engineering by Professor Herbert S. Evans, and as Professor of Civil Engineering by Professor Huntington. The new engineering building was completed and opened for classes. (It is the present Engineering Building I. The old engineering building is now Engineering Building III, and the old shop building is now known as Engineering Building II.) The Combined Engineers adopted a new constitution to take effect May 18, 1920.

1920-'21. Work was started to complete the inside of Macky Auditorium, the outside of which had been completed for a number of years. Work was also started on the new Arts building. The men's gymnasium was taken over by the chemistry department as a laboratory, as the armory was being used by the University basketball team. The old gymnasium would no longer accommodate the crowds attending the games.

1921-'22. The COLORADO ENGINEER was admitted to membership in the Engineering College Magazines Associated. Macky Auditorium was dedicated on November 5. The University Book Store opened for business. Radio station KFAJ was installed in Engineering Building I. It had a range of 1200 miles. A charter was granted to the Rho chapter of Eta Kappa Nu, honorary electrical engineering fraternity. The Liberal Arts Building and the interior of Macky Auditorium were completed. Work was started on the new men's gymnasium.

1922-'23. A Sigma Tau convention was held on the University campus October 2, 3, and 4. Five coed engineers enrolled in the College of Engineering this year. The Engineers' Ball was held February 2, at Citizen's Hall. The Tau Beta Pi honor roll was erected in the Engineering Library. Work on the power plant at Valmont was started. Since the flood in Pueblo in 1921, plans were presented and prepared by the University for flood control measures to be used in the future. Professor Eckel was added to the staff of the Civil Engineering department. The University broadcasting station, KFAJ, was becoming widely known throughout this entire section of the country; music and programs were presented daily.

1923-'24. At a cost of $65,000, the football stadium was constructed. Dedication of both the stadium and the new men's gymnasium was held on November 22, 1924, during the game with the Colorado Agricultural College team. On Homecoming Day, November 1, the score of the football game was University of Colorado 3, University of Utah 0. The team was the only one in the United States which was not scored against this year. The oldest building on the campus, Old Main, was remodeled. The historic old pharmacy building was torn down to beautify the campus. A wing was added to the University Library. Plans were drawn up for the construction of the Memorial Building to be built as a memorial to University students who were killed during the war. A high-voltage laboratory was installed in the electrical engineering laboratory. A refrigeration plant was installed in the steam engineering laboratory. It was to be used for experimental purposes only. The radio station KFAJ was enlarged. The long fight for the removal of the railroad tracks from the campus was begun. In June, 1924, the College of Engineering was host for the annual convention of the national Society for the Promotion of Engineering Education.

1924-'25. Radio station KOA was installed in Denver in the spring of this year. After a period of idleness, the University station KFAJ again went on

the radio map of the nation. Work of enlarging the chemistry building was completed during the summer; the new additions and equipment made it one of the best chemistry buildings in the country.

1925-'26. A complete telephone exchange was donated to the University. Station KFAJ lost its license and was given a decent burial due to failure of the staff to maintain regular programs. A Department of Architectural Engineering was added to the College, and the faculty expressed their hopes of making it as large as the other departments. The Chemistry annex (formerly the gymnasium) was remodeled and made into the Lecture Theatre. The University power plant received a new boiler because the old plant was not capable of handling the heating load of the entire campus.

1926-'27. Sigma Epsilon, a local honorary civil engineering fraternity, was organized. The University garage was built behind Engineering Building II. The campus had been continually improved since the completion of the new Arts Building by the addition of many trees, shrubs, flower beds, and walks. Work was started on the Memorial Building on September 30, 1927.

1927-'28. The Colorado Society of Chemical Engineers was granted a charter as a student branch of the American Institute of Chemical Engineers. It was the third student branch of the Institute in the country.

Dean Evans was named Rocky Mountain District candidate for the vice-presidency of the American Institute of Electrical Engineers. (He was later elected to this office.) At a cost of $194,000, including equipment, the new Women's Gymnasium was completed.

Three old friends—prominent men in the history of the College of Engineering—held a reunion in Boulder. They were Deans Milo S. Ketchum, Dean of the College of Engineering of the University of Illinois; Herbert S. Evans, Dean of our own College; and Ivan C. Crawford, Dean of the College of Engineering of the University of Idaho. In January, 1927, the Civil Engineering Department sponsored the first annual Highway Engineering Conference. Abouty forty representatives from the U. S. Bureau of Public Roads and from the Colorado State Highway Department were in attendance. (The conference has been held each year to date. It has gradually grown both in size and importance until, in 1934, representatives from the highway departments of seven states were present. The papers presented at this conference have been published and have been sent to highway departments all over the country.)

1928-'29. The local Civil Engineering fraternity, Sigma Epsilon, was granted a charter by the national fraternity, Chi Epsilon. Two students in the Department of Electrical Engineering this year won national prizes in a contest sponsored by the American Institute of Electrical Engineers. (These articles were the first of a series of eight prize-winning articles submitted by students of this department. Two important prizes were won each year from 1928 through 1932.)

1929-'30. The COLORADO ENGINEER was awarded first place in the annual competition for the Best Alumni Section in the Engineering College Magazines Associated. The COLORADO ENGINEER was named as the host for the 1930 Convention of the Engineering College Magazines Associated.

1930-'31. The Memorial Building was completed. The $200,000 structure was truly a University product, being financed by the students and faculty, and being built mainly of local materials by the University construction department. The Engineering Colleges Magazines Associated convened at Boulder for the best represented convention in the history of the organization. The convention was undeniably a huge success. Among other entertainments provided for the twenty-four delegates and forty-nine guests was the Annual Engineers' Applefest. At the business meeting, national Chairman Willard V. Merrihue paid the following tribute to our publication: "The COLORADO ENGINEER is a star in the E. C. M. A.'s crown. The cover is one of this year's prize winners. Colorado was the only member to rate 'class A' all of last year" [1929]. (The COLORADO ENGINEER has maintained "classA" rating for four years and three issues to date.)

1931-'32. Dean Evans was elected national president of the Society for the Promotion of Engineering Education. Fred Cooper, senior electrical, was elected president of the University Student Council. The first annual University Spring Jamboree was held. Professor John A. Hunter, head of the Mechanical Engineering Department, was elected to the board of directors of the American Society of Mechanical Engineers.

1932-'33. Dr. Norlin, president of the U. of C., spent the year in Berlin as the Visiting Roosevelt Professor of American History and Institutions at the University of Berlin. The appointment of Dr. Norlin to this position represented a signal honor to him and to the University. The Colorado Mu chapter of Pi Tau Sigma, national honorary mechanical engineering fraternity, was installed. The chapter was the first in the Rocky Mountain region. Bureau of Reclamation engineers, working on a plaster model of the Hoover Dam in Engineering Building I, discovered weaknesses in the design of the proposed Hoover Dam itself, and the existing design was slightly changed. Frank M. Starr, e., '28, editor 1927-28 of the COLORADO ENGINEER, was awarded the Albert Nobel Prize for his paper, "Equivalent Circuits" presented at the winter convention of the American Institute of Electrical Engineers.

1933-'34. The local student branch of the American Society of Mechanical Engineers became a Junior Member branch. Members of the new organization enjoy all the important advantages of senior members. Bureau of Reclamation engineers furnished a series of about a thousand tests upon the second model of the Hoover Dam built here. The model exemplified a new development in building model dams,

(Continued on Page 80)

The site of the Boulder Dam—an early picture. Those who visited the dam during spring vacation found the dam already built over 200 feet high. *(Cuts courtesy Union Carbide and Carbon Company.)*

What We Saw at the Boulder Dam

By Al Baumgartel, *C.E., '34*

On Saturday morning, March 17, during a heavy spring snow, Professors Eckel and Brubaker, with a group of student engineers had the privilege of leaving Boulder, Colorado, for a trip to Boulder City, Nevada, for an inspection of the Boulder Dam.

Monday morning Professor Eckel made arrangements with Mr. Young, chief construction engineer, for our visit to the project. We first went to the gravel pit, which is located 12 miles upstream from the dam. The gravel is loaded into dump cars with a five cubic yard electrically-driven drag-line. The loaded cars are pulled six and a half miles to the gravel plant where they are taken either to the stock pile or proceed directly to the plant. There the gravel is dumped into hoppers. A rubber conveyor then takes it to the first screen. The gravel is segregated into six different sizes, ranging from a maximum of nine inches to a minimum of ¼ inch. All gravel is screened and washed twice. Specifications require the sand to have a fineness modulus of 2.75-3.25. The raw gravel has an excess of 28-48 mesh material; this is removed by two rake type classifiers and recombined in proper proportions. Washing removes all material below 200 mesh. Plant capacity is 700 tons per day.

Next we visited the refrigerating plant which is situated on the downstream cofferdam. Because of the immense volume of concrete, the heat caused by chemical action in the cement cannot be removed sufficiently by natural processes; therefore, an elaborate system for artificial cooling has been provided. The air compressors that were used in the tunnel construction are now used for the ammonia compressors.

The cooling tower is designed to cool 6,000 gallons per minute. This cooled water is pumped through 14-inch pipes to the 8-foot slot in the dam and there distributed by 1-inch horizontal steel pipes imbedded in the concrete. About one foot of pipe is necessary for every cubic yard of concrete.

From here we rode on a skip to the top of the dam, a distance of 325 feet from the foundation. The dam is being constructed in the form of interlocking vertical columns, the joints between which are to be grouted. The average size of columns is about 40 feet square. A five-foot rise is made at each pouring. Each lift is finished off with horizontal keyways 26x5½ inches and set 10 feet apart. About two hours are required to fill the average size block, and 72 hours must lapse between pourings. During that time the concrete is kept wet to provide proper curing.

The concrete is delivered on location in eight-yard, bottom discharge, buckets. A safety catch will not allow the bucket to discharge until lowered on the surface of the concrete at the point of pour. Buckets and other materials are handled by a system of six cableways that span the canyon.

Cableways No. 5 and No. 6 are the longest with a span of 2,575 feet. The head and tail towers are 90 feet high and will clear the top of intake towers when completed. They have a horizontal movement of 800 feet. Cableways No. 7 and No. 8 have spans of 1,400 feet and operate on concentric tracks. Cableway No. 9 has a fixed head tower on Nevada side and tail tower that moves in an arc of 800 feet in length. These five cableways belong to the six companies and are rated at 25-ton capacity.

The government has built a permanent cableway to serve the power plant. It has a rated capacity of 150 tons and a span of 1,200 feet. The carriage rides on six 3½-inch cables and adjustment for an equal tension is provided by hydraulically operated jacks.

We then went to inspect the four intake towers which are located in large cuts in the canyon walls. The towers are connected to the 30-foot penstock tunnels, and flow will be regulated by steel gates. The one which we mounted is now 85 feet high and final height will be 384 feet. The towers are constructed of concrete, reinforced with a multitude of 1¼-inch square bars.

The following day we visited both spillway structures. They are designed to handle 400,000 second feet. This is 50% excess of any known flood. Each spillway has a weir length of 400 feet and overall length of 700 feet to the entrance of the 50-foot discharge tunnels. The two contain about 150,000 cubic yards of concrete and required about 700,000 cubic yards of rock excavation. Four automatic steel drum gates will be placed in each spillway to control the flood flow.

A very interesting portion of the inspection was the high-mix plant. Here the concrete is mixed in five four-yard mixers. All aggregate, cement, and water is weighed in automatic hoppers and is transferred to the mixers by one operator at a control board. A continuous record of each mix is obtained by an automatic recording machine, and another unique feature is the record kept of the power needed to turn the mixers. A measure of consistency is thus obtained.

Water-cement ratio of 0.53 and one part cement to 9.5 parts aggregate is used.

Our next visit was to the plant of Babcock and Wilcox Co., where the record breaking steel pipe for the tunnels is being fabricated. Steel is shipped in flat plates; the largest are 32 feet long by 12 feet wide and 2¾ inches thick. These plates weigh 23 tons apiece and two constitute a freight-car load. Three of these are fabricated into 12-foot lengths of 30-foot pipe.

The plates are first marked to pattern and the edge is planed. They are then moved to a vertical bending roll, where they are shaped to cylindrical forms. This roll can impose a load of 3,500,000 pounds on the plate. The plates are then brought to final shape and are spot welded together. They are then placed in automatic welding machines and the V-shaped groove made by the planer is filled.

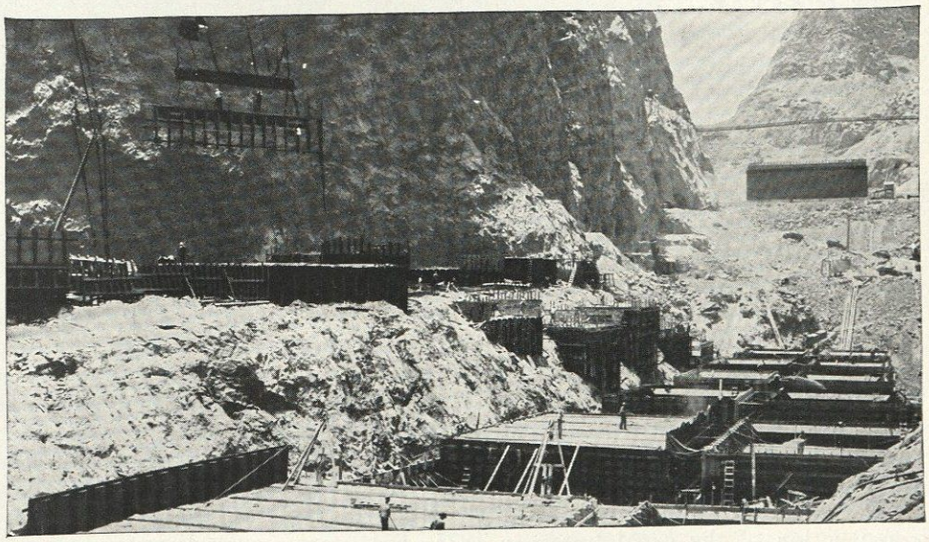
Every inch of the weld is photographed by X-ray for inspection. Films are developed in an adjacent laboratory, and in case of any defect noted, the weld is chipped out and rewelded by hand.

After X-ray inspection the pipes are given a stress-relieving treatment by heating them in a furnace to about 1,200 degrees F.

In the evening the whole group visited the dam-site to see that great project under the thousands of lights. Much the same ground was covered as in the morning except a party was organized to visit one of the nearly completed 30-foot penstock tunnels. The penstock tunnels start at the bottom of the intake towers and will provide the water for the turbines. Tunnels 13½ feet in diameter lead off to the power house. They are now concrete-lined and later to be lined with steel pipe. This tunnel was formerly one of the four 50-foot diversion tunnels. At present only one diversion tunnel is used because river flow is 10,000 second feet.

The following Wednesday noon, we left Boulder City, stopping in Las Vegas for several hours and also in Salt Lake City, arriving home Friday morning.

We are deeply indebted to Messrs. Hillyard, Decker, and Spearman, graduates of C. U., for their splendid guide services.



When this picture was taken, the work was over a year ahead of schedule. Cooling coils of 1-inch pipe are buried in the concrete blocks as the blocks are poured.

The Delaware and Hudson Canal — An Early Engineering Feat

By Dolf Campbell, *C.E., '34*

This is an abstract of the paper winning fourth place in the recent article contest sponsored by the COLORADO ENGINEER. Lack of space made it necessary to present an abstract instead of the complete paper as it was submitted in the contest.—Ed.

LAST summer I had the opportunity, with the company of an engineer, to travel along and view the ruins of one of the oldest and most famous waterways ever constructed in this country. This waterway, known as the Delaware and Hudson Canal, ran from the northeastern coal fields of Pennsylvania to a town on the Hudson River in New York State called Rondont, a distance of 100 miles. The initiative for the construction of this canal was due to the hobby of a business man from Philadelphia, who was taking long tramps through the hills of Northeastern Pennsylvania to collect different specimens of rock. On one of his tramps in 1812 he picked up some black rock. The finding proved to be anthracite coal, and it was not long after the discovery that this northeastern part of Pennsylvania became known as one of the richest sections in the country for coal. The coal was shipped to Philadelphia by boat down the Delaware River, but there were no convenient means of transporting it to New York, as railroads had not yet been built.

This view of a lock section of the Delaware and Hudson Canal gives a good impression of the stone work which has endured for over 100 years as silent testimony of the skill of the builders.

Through much influence, the Pennsylvania Assembly passed an act in 1822 to the effect that a canal was to be built to New York. Shortly after this act was passed, the New York State Legislature passed an act of incorporation for the construction of a canal with suitable dimensions from a point on the Hudson River to a point on the Delaware River. This corporation was also instructed to purchase all the rights from the Pennsylvania Act and to purchase also some of the coal fields—which it did. After some funds had been raised and the surveys had been completed, the construction of the canal began in 1825. Six years afterwards, the canal was opened to traffic. Sections of the old waterway can still be distinguished and the tow-paths used by the mules in towing the boats can still be found hidden under brush and rock. The prism of the canal was twenty feet wide at the bottom and thirty feet wide at the water-line. The depth of the water was about four feet. Over the canal route, the elevation that had to be overcome was approximately 1,100 feet and, in order to overcome this, more than one hundred locks were needed. The boats used were about seventy feet long, drawing three feet of water, and capable of carrying thirty tons of coal. For upkeep, tolls were charged, the average rate being eight cents per ton mile for coal and half that price for other merchandise.

As we rode on, we came to a beautiful old suspension bridge, one of the first built in this country, used originally as an aqueduct to carry boats across the Delaware River, but now used as a viaduct. We paid our toll at the bridge tender's house, looked over the quaint structure, and went on our way to a town called Honesdale, the western terminus of the canal. The most interesting section of the entire canal was here at Honesdale. The coal mines were approximately fifteen miles from here, and between these two points a ridge of mountains, rising perhaps 800 feet above the river level, had to be conquered. The scheme which was adopted was that of constructing a railroad commencing at the mines and carried to the summit level by five planes in about three miles. Steel cables passing over sheaves and steam power from stationary engines were used on the ascending cars. After passing the summit level of a mile and a half there was a sharp, descending grade of probably ten to fifteen per cent. To retard the motion of the cars, a curious contrivance composed of sails connected with gearing was

used which, while revolving in opposite directions, held the cars back to a velocity of about four miles an hour. The cars were then drawn by gravity down into Honesdale where the coal was transferred to the boats.

As we turned homeward, our thoughts centered upon the designers and engineers of this once famous waterway. Here was a piece of work constructed when engineering, as a profession, was very young. The knowledge men had along this line was not acquired in institutions, but in the field through years of experience. Most of the best works of these pioneer engineers can no longer be seen, for they have been pushed aside by the last century of progress, but monuments of their skill and labor, such as these old canals still remain here and there. One reason for the success of the early engineers was their own personal characters, for, it is evident that judgment and accuracy marked each step of their undertakings. Another reason for success was probably their freedom from politics—our outstanding handicap today. Men were then selected according to their merits, and not on political preferences; therefore, their interest was wholeheartedly upon their tasks. Traveling next to a piece of work, such as the antiquated canal, one could not help but admire the wonderful skill with which those early engineers labored. There was no speedy method of transporting surveying parties and no comfortable living conditions for the workmen; hardships were many, but regardless of all these inconveniences there emerged a canal—a canal of such stupendous quality that I wish that at least some sections of it could be preserved as a monument to those admirable pioneers of our present-day profession of engineering.

The Outlook for the College Student

By Robert B. Bonney,
Vice-President, American Institute of Electrical Engineers

IN 1929 there was keen competition among the great industries for the employment of engineering, and other, graduates of that year. In 1934 there is keen competition among engineering seniors, and others, for employment in the industries. This reversal in demand is not due to any change in the long view requirements of the industries for engineering talent. On the contrary, the rigid economies and greater efficiency made imperative by the times are likely to bring about a more insistent demand for well-grounded technical men than ever before when the outlook becomes less obscured by the present uncertainty of economic conditions. The industries know the value of the right kind of men who have been able to take advantage of an engineering education. Studies have been made of the relation of success in college to that in business, and the results are favorable to college graduates of high standing in scholastic and personal qualification.

In considering men for the industries, emphasis is placed on the fitness of the individual for the job rather than upon his need of work. Interest in the industry or business on the part of the applicant is one of the primary factors in the consideration of his qualifications for employment. Some knowledge of the organization, policy, and aims of the company in which the connection is desired and the ability to discuss these matters with the employment representatives is of considerable importance. It appears that one will do his best work in the thing in which he is most interested. This is true in college as well as in life's work. If one takes up in college the course most interesting to him, he will do his best and, likewise, a real interest in the life work he chooses will go far in assuring progress. With a good educational background of fundamental character, such as an engineering course, and a real interest in the work problems of his job, an individual will naturally keep up his study habits in order to keep pace with his interests and thereby is more than likely to make satisfactory progress.

The methods of approach in looking for employment must vary a good deal according to the type of organization and the personalities of the men with whom the applicant is to deal. For the approach, it is well for one to attempt to find out something about the man he wishes to interview, or to get acquainted with him beforehand. Perhaps it may be possible to bring about such an opportunity by attending engineering society meetings. It will then be more evident how to open with him the question of employment.

In looking for a permanent connection, it would be a mistake to apply merely for a "job" or to indicate that the type of work is not important. To express a desire for just "anything" puts one down as an individual with no particular aim in life. Have a fairly definite program in mind and, while it may not be possible to follow this through, it will at least convey the impression of knowing something about what you want to do.

It is important to keep up affiliations with men of the profession. No better way than membership in the appropriate engineering society and attendance at its meetings could be imagined.

1. Competition for men has changed to competition for jobs.
2. Industry will continue to need technically trained men.
3. A fairly definite life program is desirable.
4. Some knowledge of the organization and policy of the prospective company employer will be helpful.
5. An interest in the work desired is important.
6. Association with men of the profession is of advantage.

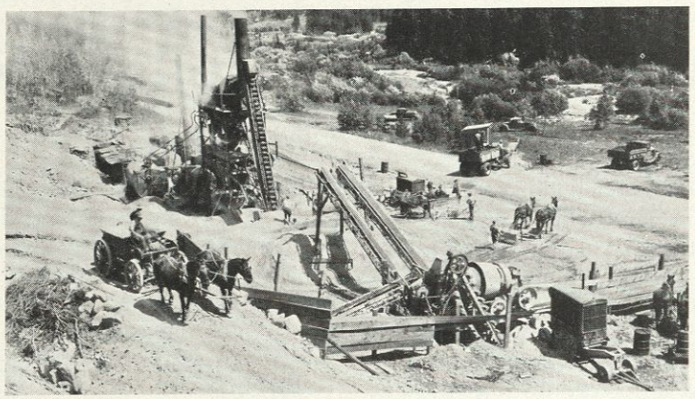
Oiling of Berthoud Pass

By George Barkhurst, *C.E., '34*

Abstract of original paper submitted. This paper, based on the personal experience of the author, was awarded second prize in the COLORADO ENGINEER article contest.—Ed.

BERTHOUD PASS is an important link in the transcontinental Route No. 40 passing through Denver, and is also part of the famous Circle trip to Estes Park. Due to the rapidly increasing traffic, amounting to 52% in 1933 over 1932, a type of hard surface was necessary to insure year round traffic.

This road from Empire, Colorado, to Fraser, Colorado, was constructed by the United States Bureau of Public Roads, and the surfacing described was done under the supervision of Mr. C. E. Learned and Mr. W. W. West. The project was let as an Unemployment Relief project, using all unskilled labor from the two counties in which it was located.



Close up view of plant operations on the Berthoud Pass road oiling program.

It was decided to use an oil surface for several reasons. Economically the road would not justify a concrete surface, and oil provided more traction in wet weather, prevented dust, and was more suitable to the weather changes experienced in this location.

The contract was awarded to Hamilton and Gleason Construction Company of Denver in the summer of 1932, but very little work was completed until the spring of 1933. About 60 men were employed, divided into two shifts, each working 5 hours per day for a 30-hour week. In addition, the Bureau engineering crew consisted of an engineer in charge, plant inspector, weightmaster, road inspector, and one man taking sieve analysis of the aggregate.

The project covered a total of 17.28 miles, 7.5 miles being on the east side of the pass and 9.78 miles being on the west side. The type of oiling was the plant mix, consisting of a prime coat of MC-1 (Medium Curing Type), capable of developing bond and improving stability of the base coarse. A pre-mix surface consisting of aggregate and road oil 70, combined at a central mixing plant (see illustration) where each was weighed separately and mixed in proper proportions. The amount of oil needed was estimated in specifications to be between 4% and 6% of the weight of the dry aggregate, but the exact proportions on the job were determined from Campbell's formula. The pre-mix was delivered to the road in power dump trucks and dumped into a spreader box in order that the amount to cover the entire width of the base for a unit of length of roadway could be spread over one-half of the width and then bladed to a uniform depth of 3 inches loose, reduced after rolling to about 2.25 inches. There were 22,220 tons of the pre-mix laid, and 1,400 tons placed in two stock piles. The method of measurement and payment was of the unit price bid per ton.

After the pre-mix oil surfacing had been opened to traffic for a period not exceeding four weeks, a seal coat was applied, consisting of Cut-Back Asphalt (C. B.-2) and stone screeings applied to take up all excess oil. A ten-ton roller followed immediately after the truck spreading the screenings.

Despite many minor problems, which would be expected, the project was completed about September 15, 1933.

The Colorado State Board Examination for Architecture

By Martin Phillip Capp, *Arch.E., '35*

AFTER four and one-half years of college work in architecture, the summers of which were spent in architectural drafting in a Denver office, I persuaded myself that a try at the State Board Examination for license to practice in Colorado would not be amiss. Application was made, and three long months were spent in intensive research and preparation. At the beginning of the second week in January, with T-square under my arm and hope in my heart, I journeyed to Denver, there to go through the longest, hardest four days of my life.

I have been asked to write of my experience, of the preparation for the ordeal, and of the examination itself. As to preparation, I spent, first of all, many hours with my employer in Denver, an architect, securing hints on the subject matter of the examina-

tion and suggestions as to topics of study. Then came a talk with the Secretary of the Board, who kindly gave me further suggestions. Then came the study itself. Every phase of professional practice was investigated. Standard forms of the American Institute of Architects were invaluable, and case contracts were read, as were actual estimates and office records of many different jobs. Handbooks were studied, not only to learn the location of information, but also to understand how these data were obtained. Actual structural problems were worked out and studied over and over. History was reviewed. In short, the entire preparation took the form of an intensive three-month review of the art of architecture, both in design and practice.

And now for the examination itself. The work covered four days, divided into morning and afternoon periods, of which the former includes the time from eighty-thirty until twelve noon, and the latter from one until five o'clock. Each candidate has an individual drafting table, is supplied with pencils, erasers, tracing paper, scratchpads, and thumb-tacks, but is expected to use his own drafting instruments and handbooks. Members of the examining board are in attendance constantly, and are ready to explain any point in a question which is not clear.

The four days of the examination were divided as follows: First half of first day, professional practice and history; second half, specifications; first half of second day, engineering; second half, engineering (graphics); first half of third day, details; second half third day and entire fourth day, design.

Taking up the topics listed above separately, I might describe briefly the type of questions asked. During the first half of the first day questions were asked concerning professional practice, including in scope the subjects of bonds, contracts, bids, payments, sketches, fees, agreements, inspection, and so forth. The candidate should be able to write out a complete form of contract between the various contracting parties of a job, and he should have an intimate knowledge of the Standard Forms of the Institute. Also in this half was included history of architecture, covering descriptions of all historic styles and a tracing of their development, and the identification of certain modern buildings as to style. The second half of the first day was given over to questions on specifications, in which complete specifications of various phases of construction were to be written out. Subjects covered were foundation concrete, stucco, certain paint jobs, and some phases of carpentry. Also included in the afternoon section were general questions on materials and various types of construction. No handbooks or memoranda were allowed in this day's work.

The first half of the second day was occupied with a question on the design of certain features of a warehouse building in steel, concrete, and timber. This question required a knowledge of mechanics of materials, reinforced concrete, and statics. The second half of this day included questions on graphics, such as shear and moment diagrams of beams, graphic determination of stresses in a truss, and an algebraic check of all methods.

The first half of the third day was spent in drafting full-size scale drawings of various structural details such as wood stairs, mouldings, lath and plaster walls, doorways, wood frame windows, and the like. Only a candidate with actual office experience could hope to perform this part of the work satisfactorily. This half-day also included questions on drafting, such as illustrations of various methods of perspective.

The second half of the third day, as well as all of the fourth day, was spent on the design problem, which counted a good thirty-five per cent of the total number of points. During the afternoon of the third day the problem was presented to the candidate in program form, and an esquisse was to be sketched and turned in at the end of the day, which was to be rigidly adhered to in the following day's drafting of the presentation drawings. This year's problem was a chapel for an educational institution, to seat about two hundred and to be of Gothic or Romanesque style. No restriction was placed on site, orientation, or cost, but the institution was specified to be of one or another of Episcopal, Lutheran, or Roman Catholic denomination. The entire fourth day was spent in drafting a set of presentation drawings to one-eighth inch scale, showing plan, elevations, and two principal sections. There were to be no detail drawings. The designs were judged on the basis of presentation, adherence to the program, and solution of the problem. All drawings were made on tracing paper, and no lavish perspectives in charcoal or color were required. The logic of the design was an important factor in the judgment of the solutions.

Of the five men taking the examination this year, two were passed, which, I am told, is about the average result. A grade of seventy per cent of the total number of points is required for passing and awarding of the certificate. In the State Board Examination "cons" do not count.

THE ENGINEER'S NEGLECT

Do we not, as engineers, neglect many educational opportunities? Do we take as much interest as we should in the subjects outside of regular engineering courses? Too many of us are getting a head full of technical knowledge with very few ideas on foreign affairs, American government, and economic conditions. Although some engineering students seem unaware of the fact, we have an excellent library at our disposal. With this splendid opportunity for constructive reading, we should gain a wide perspective on politics and economics, but very few of us do. Even though engineering is a hard course, surely we can find time to read some material outside our textbooks and leave the University as more than narrow-minded engineers.

The Colorado Engineer

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VOLUME XXX, No. 4 | Founded 1903 | MAY, 1934

EDITORIALS

THIS is the Thirtieth Anniversary number of the COLORADO ENGINEER. We make no apology for the small size of this issue—early in the quarter we had visions of a great number in commemoration of thirty years of progress of the College of Engineering. Then we found that the ENGINEER did not have enough money to finish the publishing year. In fact, the debit side of our ledger just about balanced our credits when we began work on this issue. The faculty advisory board met and listened to the very sound argument that the ENGINEER should discontinue publishing before it built up a deficit. While all realized the seriousness of the situation, the immediate response to the argument presented was that in some way, by saving here and there, by collecting outstanding bills, by cutting down the size of the magazine—we would publish our thirtieth anniversary issue—and here it is. We are proud of it, as it represents the best that we, the staff, are capable of presenting. We hope that this issue is a fit commemoration of thirty years of progress of the College of Engineering. The interest and loyalty of the staff have grown throughout the year. We who will be graduated in June leave next year's magazine in the hands of a completely organized and competent staff. Training throughout this year has fitted each member for the position which he will hold next year. The first three issues presented this year received the class "A" rating from the Engineering College Magazines Associated, making a record to date of four years and three issues of the fifth of consecutive class "A" rating. We like to feel that the rating is merely the reflection of the interest Colorado engineers have always shown in their magazine. The COLORADO ENGINEER will continue next year, and, we predict, will faithfully record the achievements during another thirty years of progress.

OUR BIG DAY

Amid the hustle and bustle of preparation for Engineers' Day, the College of Engineering extends a most hearty welcome to all its guests. These guests find many questions to ask, seeking explanation of mystifying processes, odd phenomena, and strange apparatus. The more questions that our guests can ask us the better we will like it, although, no doubt, the outstanding question of the day will be "What is it good for?"

The ability of the engineers to give more than just general answers to these questions will, of course, depend upon their knowledge of the subject, and the more the questions asked them, the greater must their knowledge necessarily be. And so we come to the prime objective of Engineers' Day. "What is it good for?"—that is the question which will impress upon the student engineer's mind his real purpose and will clarify the aims of research and the ends of education which he is seeking.

Engineers' Day provides a sort of self-examination for the student and he should make good use of this opportunity because such opportunities are few at best. And so, perhaps the College's guests on Engineers' Day will have left behind them more of profit than they take away.

A SUGGESTION FOR NEXT YEAR

In any number of fields of human relationships, the past few years have brought out serious weaknesses which have affected millions of people—engineers as well as others. Our economic system has shown itself to be suspiciously like a failure. Present tendencies in international relationships make one wonder if our system in that field is not also a failure. Countless other problems have arisen and old ones again forced to our attention.

For the most part our engineering schools have neglected these problems, confining their activities to technical training. Problems of engineering have been dealt with faithfully and closely—while the world in which the engineer must live has been largely ignored.

Is it not as important that our student engineers should be informed on the problems of economics, politics, and world peace which are facing them as citizens as it is that they know how to design machinery for which at present there is no demand. Surely it must be. Whether they like it or not, the engineering schools need some changes. Efforts to "broaden the engineer" should not be left to the last one or two years of school. For most students, a year's course in traditional economics accomplishes but little in the directions indicated above. There should be courses in international relations, public finance, problems of government, and economic opinion. Throughout the college course there should be seminars for discussing current problems and affairs which would bring together different viewpoints and cause the student to think these things through for himself. These steps seem advisable even if it means dropping certain present courses.

THIRTY YEARS OF PROGRESS

Thirty years of progress have been traversed since the COLORADO ENGINEER first went to print! We would like to believe that statement; however, when we run over those years, tracing developments by the various issues of the magazine, we begin to wonder—we even become skeptical. About 1929 a break in our speed of material development was made by the economic collapse of our country and of the world in general. A violent set-back was experienced by the whole engineering profession; engineers by the hundreds were made jobless; the social structure had to be given a chance to catch up with industrial developments.

In this period of waiting, engineers have learned new things. They have learned that the engineer is a definite, necessary cog in the gearwheel of society, and that only by increasing his knowledge can he hope to operate efficiently as a part of the social machine. Let us hope that in the next thirty years, the moral, social, and spiritual development of the engineer will keep pace with mechanical improvement.

EXPRESSION

It has often been stated that an engineer is a success only to the degree to which he is able to express his ideas to other people. A man may have wonderful ideas, but how can he hope to carry them into effect if he cannot express himself in a manner which will inspire the confidence of others? No organization will intrust its funds to a man who cannot stand on his feet and say what he has to say, or who cannot write a clear, concise business letter or report. The Department of English in the College of Engineering, one of the developments of our thirty years of progress, offers worthwhile electives in public speaking, the essay, business correspondence, the preparation of reports, and technical journalism which can be worked into any schedule if the student has the earnest desire to broaden his education.

Campus Notes

ENGLISH DEPARTMENT CONDUCTS BOOK REVIEW CONTEST

In cooperation with the national council of teachers of English, the department of English in Engineering at the University of Colorado is conducting a book reviewing contest. Several good books will be awarded to the students submitting the best reviews. The winning articles will then be sent to the council for national competition. The best reviews in the national contest will be published in the third edition of "The Students' Guide to Good Reading." Miss Virginia Sink, Sophomore in the College of Engineering at the University, is the author of one such review which was published in the last edition of The Guide.

A committee of freshman engineers under the direction of Frank A. Grismer, graduate student and instructor in the Engineering English Department, is busy revising a section, "The Short Story," for the next edition of The Students' Guide, which is published by the National Council of Teachers of English.

COLORADO ENGINEER BANQUET

The annual banquet of the COLORADO ENGINEER staff was held the evening of May 17. About forty members of both staffs were present. In addition, the newly-elected and the outgoing presidents of the six honorary engineering fraternities and of the student engineering societies, the winners of the first four places in the student article contest, the faculty advisers and the members of the faculty advisory board, and a few special guests swelled the crowd to nearly seventy.

After the banquet, plans were discussed for the coming year. The spirit of cooperation manifested by the leaders of next year's student body removed many doubts as to the fate of next year's ENGINEER.

Charles Blessing acted as toastmaster. Among the talks of the evening were those given by Professor W. O. Birk, Professor W. C. Duvall, Dean Evans, and Sterling Huyett.

ALUMNEWS

'33

Arnold N. Anderson, m, was married to Miss Robin Irvine, also a Colorado University graduate, Christmas Day, 1933, in Denver, Colorado.

Ray D. Rettenmeyer, e, is with the Bryan-Davis Publishing Company of New York. He lives at 150 Cent. Avenue, Madison, New York.

Norman J. Castellan, c, is the father of a baby daughter born March 19, 1934. Mr. Castellan is an instructor in the civil engineering department at the University of Colorado.

'32

Francis R. Hannen, ch, was married to Miss Vivien Jones of Wellington, Colorado, February 26, 1934. Mr. Hannen is with the Spreckles Sugar Company at Spreckles, California.

W. Frederic Dowling, ch, is the father of a baby son born in Denver, Colorado, February 19, 1934.

'31

Harold E. Sheda, m, has been assigned to the mechanical engineering division of the United States Bureau of Reclamation at Denver, Colorado, as a junior engineer. Mr. Sheda was recently pledged to Pi Tau Sigma, honorary mechanical engineering fraternity, at the University of Colorado.

John H. Hayes, ch, is with the National Carbon Company at Niagara Falls, New York. His address is 527 Vanderbilt Avenue, Niagara Falls, New York.

Fred E. Cornwell, e, is the father of a baby daughter, Constance Claire, born August 19, 1933, at Casper, Wyoming.

Elmer A. Schwalm, e, died March 13, 1934, at Fairplay, Colorado, from injuries sustained in an automobile accident near there March 4, 1934. Mr. Schwalm was basketball coach at Grand Junction Junior College, Grand Junction, Colorado, and was on his way to Denver to the Amateur Athletic Union tournament when his car overturned on a notoriously dangerous hill.

William J. Dowis, e, announces the birth of a baby daughter at Kingston, Pennsylvania.

George Y. McBurney, m, is educational adviser for Camp S P 2 C of the Civilian Conservation Corps, located at Sixth and Water Streets, Boulder, Colorado.

'30

Joseph H. Powers, m, is a research engineer for the Gilbert and Barker Manufacturing Company, Springfield, Massachusetts. Mr. Powers received the degree Mechanical Engineer from Yale University in 1932.

H. Marshall Pitney, c, is located at 3300 St. Charles Avenue, New Orleans, Louisiana. He is on a bridge building job for the McClintic-Marshall Company.

'28

Lawson Egerton, ch, of the Bell Telephone Laboratories in New York City, is the author of an article on "The Oxidation of Organic Substances" in the April, 1934, issue of the "Bell Laboratories Record."

'26

Dallas J. Frandsen, e, was married to Miss Carolyn Witte in Tulsa, Oklahoma, August 26, 1933.

Edwin S. Hall, m, is the author of an article, "Ideal Transmission Performance Set as Criterion for Development," in the April, 1934, issue of the Society of Automotive Engineers Journal.

'24

Neil P. Bailey, m, has been appointed head of the department of mechanical engineering at Iowa State College, Ames, Iowa. Professor Bailey, one of the youngest department heads ever appointed at Iowa State, resigned from the faculty of the University of North Carolina to take the new job.

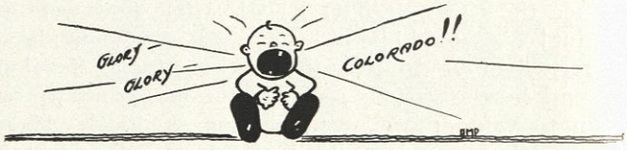
'23

Russell C. Putnam, e, Assistant Professor of Electrical Engineering at Case School of Applied Science, is chairman of the Cleveland, Ohio, section of the American Institute of Electrical Engineers. He was the author of an article "Graphical Illumination Computations" in the December, 1933, issue of the "General Electric Review."

Jack N. Withers, c, until recently of Gary, Indiana, has been transferred to New York City, New York.

'20

Edwin G. Carpenter, c, is the father of a baby daughter, Mary Ella, born November 19, 1933, at Western Springs, Illinois.



'16

Willard W. Rusk, c, formerly of Denver, Colorado, has been made chief engineer and geologist for the Amarillo Oil Company at Amarillo, Texas.

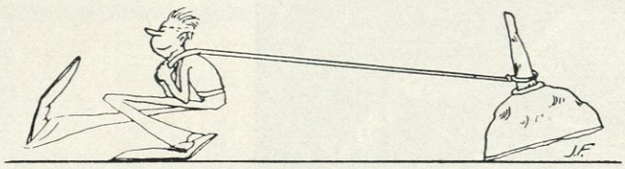
'14

John D. Slye, c, supervisor of Federal Aid roads for the United States Bureau of Public Roads, has been transferred from Wyoming to New Mexico.

Grover W. Barrier, e, passed away at Oklahoma City, Oklahoma, February 2, 1934.

'08

Roy C. Heaton, e, is an electrical engineer for the Tennessee Valley Authority at Nitrate Plant, Alabama. Mr. Heaton is at present working on an electric furnace for making phosphoric acid.



THE OIL CAN

The Honorary Society of Lubrication Engineering. Dedicated in perpetuity to the services of science, that the cause of lubricity shall lack no champion, and that friction shall not thrive unopposed.

A TRIBUTE

This grand and noble Order now fondly will recall
The mem'ry of the slickest, greatest Oiler of them all,
Will pay a worthy tribute to a pioneering member,
Whose divers, subtle boners were too many to remember.

This most outstanding Oiler of our most revered Society
Was pledged as Honorary, in the right of all propriety,
For he was no undergraduate when his famous thoughts were born,
Lo! He was of the faculty, whence the cleverest schemes are drawn.

By popular endearment rose a custom 'round him quaint:
He was dubbed of his department the respected "patron saint."
And you who seek the traditions of the Oil to carry on
Must ever strive to emulate that Oiler—"Uncle John!"

AS THIS is the thirtieth anniversary of the COLORADO ENGINEER, it is most appropriate that we celebrate the twentieth anniversary of the Society of the Oil Can. (See the connection?) In March of 1914 our honorable predecessors founded this sublime society. Twenty years have wrought many changes and improvements in the association. The secret sign and password, however, remain the same. The next paragraph is only for brothers so others please refrain from reading.

In case a member sees another probable member, he pulls his large oil can from under his coat and squirts oil on the other's shoes. If the other person is a member, he will do the same. The password (perhaps you have forgotten) is "Oil in your ear."

The final list of new members for the year includes the following:

Dolph Campbell, a senior civil, lived with a lawyer last fall and learned something hitherto unknown to the senior civils in Professor Eckel's Contracts class. According to Campbell, **gratuitous promises** should be called **gracious contracts.** Maybe the lawyers didn't know this either.

It was discovered in a recent ASME meeting that Garwood Andersen is working on an airplane engine flywheel which will rotate in a direction opposite to that of the propeller, in order to offset the turning torque of the propeller.

Walt Briggs, a junior chemical, was discussing the painting of the walls in the new women's dormitory. He said that he would sure enjoy painting those walls as there were 28,000 **cubic** yards of wall space. Maybe Mr. Briggs can tell us how many CUBIC yards of grass area there are on the campus.

How easily true genius may pass unhailed! While most of Mr. Thoman's M. of M. class were pondering the mysteries of shear on bolt-threads, Dave Hake developed and propounded the idea of using square bolts.

Such genius as this gives us confidence that the cause of lubricity shall never lack a champion—we close the books of 1934 with a smile. Goodby and good luck—oilers.

REMOTE CONTROL FOR SHORT-WAVE TRANSMISSION SET

West Moe, senior in the department of electrical engineering, has a remote control method of operating his short-wave amateur radio station, W9GGN. The entire station is controlled through four wires from a small control panel four inches square upon which are mounted three small rheostats which vary the current in a six-volt circuit. The first rheostat controls a selective relay which controls the power circuits to the transmitter and receiver. The first position on the rheostat energizes the selective relay sufficiently to close the first of its three sets of contacts; this energizes a second relay, which turns power into the receiver. The second point on the controller rheostat closes the second contact on the selective relay, which in turn actuates another relay that applies power to the filaments of the transmitting tubes. The third point on the controller rheostat closes the third contact on the selective relay, which closes a 3-pole, 1000-volt switch energizing the plate circuits of the transmitting tubes. A time-delay relay prevents application of plate current to the tubes until the tubes have had time to heat up. Another relay grounds the receiver antenna. The transmitter is completely protected by overload relays, which disconnect the station from the power mains in case of excessive currents in any circuit. The receiver is tuned by a rheostat on the control panel, which varies the current flowing in a solenoid, which in turn varies the spacing between the plates of a specially designed variable condenser. The third rheostat on the control panel controls the volume of the receiver.

Thirty Years of Progress

(Continued from Page 69)

for it was made of a very yielding material, a compound of rubber and litharge. Of interest to the campus is the Greek Amphitheater on Flagstaff, a lasting monument to President Roosevelt, which was constructed by camp SP2C of the Civilian Conservation Corps. The new Women's dormitory is rapidly nearing completion. The engineers dispose of the traditional lawyers' derby for all time! At the game with Colorado State Teachers College, the engineers tied this object of so much rivalry between the engineers and the lawyers to about twenty toy balloons and released it. For all we know, it is going yet!

G-E *Campus News*

STREAMLINED MOTOR

The new automobiles and airplanes have nothing, as far as streamlining goes, on an electric motor recently manufactured by General Electric. And undoubtedly many visitors to Langley Field, in Virginia, where the motor is now located, will think it some kind of miniature "Zeppelin." The motor is being used in investigations of the noises made by various types of propellers, the objective, of course, being to design a propeller in which noise is reduced to the practical minimum.

The motor, of the wound-rotor induction type, rated at 200 horsepower, is probably the first of its kind ever built. The propellers are mounted directly on the motor shaft, and can be run at speeds of between 1000 and 3600 rpm. The noises are picked up by a microphone and analyzed by means of special measuring devices.

The motor was designed by C. J. Koch, M.I.T., '24, and M. H. Wells, Syracuse, '02; and the control by A. Suksdorf, Washington State, '16.

LESS NOISE

Until recently, noise has been regarded as a necessary evil, something that has come quite naturally with higher speeds and more complex civilization. But someone noticed that noise gives us the "jitters"; rubber tires began to appear on milk wagons, and rubber cushions on ash cans. So, when General Electric was developing its air-conditioning units, noise became an important factor. Propeller-type fans, which had to run 24 hours a day to circulate air, were used, and they made too much noise for comfort. The Research Laboratory was given the job of doing something about it.

Research scientists examined the blades and found that on conventional fans all parts of the blade did not push air at the same rate of speed; in some cases, in fact, some parts pulled air back instead of pushing it forward. Blades on which every bit of surface pushed air at approximately the same speed were designed. And lo! not only was the efficiency of the fan tremendously increased, but the fan was quiet. Furthermore, a system was evolved whereby accurate fan-noise rating is possible. As a result, air-conditioning units which make no more noise than is present in a closed room on a quiet day were developed.

This quiet-fan development was done under the direction of K. D. McMahan, Oklahoma A. & M., '29, of the G-E Research Laboratory.

CHARLES PROTEUS STEINMETZ

"Guide, philosopher, and friend" to his generation of electrical engineers, he would have been 69 years old had he lived until April 9. From his 30 years of work with General Electric came the mathematical formulas involving alternating current, the discovery of the laws of hysteresis, and methods of protecting transmission lines from lightning damage.

These, to name a few, were basic aids in establishing present-day standards of electric service.

Yet, the heritage left by Steinmetz is the memory of not only a great scientist but of an essentially charming, kindly, helpful man of wide interests.

Out of the past, on the night of April 7, his voice spoke to radio's thousands—a voice that lives on a strip of film, evidence of our victory over time. Thus was inaugurated a three-day tribute to one who was loved for his human qualities as well as revered for his engineering achievements.

96-53DH

NRA MEMBER U.S. WE DO OUR PART

GENERAL ELECTRIC