The GEAR of THETA TAU

Fall, 1925

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ALBERT W. MORSE, ALPHA '26, EDITOR
2640 BLAISDELL AVENUE - - MINNEAPOLIS, MINNESOTA

PHIL J. LAURENCE, ALPHA '15, BUSINESS MANAGER
1314 N. E. SECOND AVENUE - - - - MIAMI, FLORIDA

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181 Twelfth Avenue, Columbus, Ohio.

Strategically Situated at the Gateway of Minneapolis, the New Nicollet Hotel Replaces One Which Had Occupied the Same Site Since 1858.

THE NEW NICOLLET—MINNEAPOLIS

Eta Alumnus, Contractor, Describes Construction

By C. F. Haglin, Eta '13

Vice-President, C. F. Haglin and Sons Co.

IN January, 1923, a group of the leading business men of Minneapolis decided to carry to completion a definite program laid out the latter part of 1922 for the erection of a new Nicollet hotel on the site of the old building, which has occupied a central location in Minneapolis since 1858, thereby effecting the realization of the dream of a great many Minneapolis men for the last 15 years.

After having preliminary sketches for the proposed building prepared and submitted to this body of men, C. F. Haglin & Sons Co. was given the contract for the erection of the building, but before anything definite could be accomplished in the way of plans and a construction program it was necessary to arrange for the financing of the structure. The preliminary plans and the financing program occupied the time from January, 1923, to June of that year, and inasmuch as the cut of the building and land aggregated something over three and one-half million dollars, it was, of course, necessary to complete the work as quickly as possible to keep the interest charges, which amounted to approximately $700.00 a day to as low a figure as possible.

It was decided to employ a firm of Chicago architects who have drawn the plans for a great many of the leading hotels of Chicago and the Northwest.

In order to appreciate the preliminary work which must be gone through before a proposition of this kind can actually get under way, it is well to realize that very complete plans of the structure, as well as the mechanical equipment, including laundries, kitchens, boilers, engines, refrigerating plant, electrical equipment and elevators, must be laid out and the cost of each item definitely arrived at in order that the aggregate cost will not exceed the available funds derived from the financing. It is then the contractor's problem to lay out all the necessary equipment for the construction of the building, to organize a working force on the job which is capable of meeting the time schedules previously prepared, and, not the least in importance, to provide an organization for expediting the delivery of materials. It is absolutely essential that each of the materials, which are purchased from practically all points in the country, shall arrive at the building in proper sequence so as not to cause piling up of materials which cannot go directly into place, due to lack of storage space in construction work, nor cause delays due to lack of material at a given time. These items of organization and preparation for the completion of such a job are very often overlooked entirely by the general public, who see only the work involved as the building progresses, whereas they are the most fundamental and important items in the construction industry and need the most careful study in the laying out of plans.

After exhaustive study as to the time and costs of different materials available for the construction of the Nicollet hotel, it was decided to use what is known as a reinforced concrete structure, with the exception of a few columns and steel girders necessary to span the main lobby. Working plans were prepared along these lines.

The plumbing work consisted of wrecking the old buildings on the site,

occupying the entire area, and the excavation of approximately 30,000 yards of dirt and 5000 yards of rock which was encountered about 25 ft. below the curb.

The structure is supported on foundations, a part of which are of the usual spread type, resting on sand, and caisson work carried down to rock for the boiler room. The most modern construction equipment to be had for this kind of work was selected, including a steel concrete tower and counterbalance chutes, which eliminated a great deal of handling by wheelbarrows or concrete carts and also expedited the concrete work through the ability to spout the concrete material directly above other workmen who were erecting the wood forms at the same time.

The excavation was started on July 10, 1923, as is seen by the accompanying photograph, and on August 21 foundations were complete and the first floor centering was started. On September 6, the first floor concrete work was practically complete and the second floor centering was well started. From this point on, the concrete structure rose rapidly, a record for the Northwest being established by pouring seven complete floors of over 25,000 square feet per floor in 28 days.

As soon as the concrete work had been carried to the fourth floor, the brick and stone work was started on the ground level, and it followed the concrete work at the rate of approximately a floor a week. On November 1, the concrete frame was up to the eleventh floor and the brick, stone and terra cotta work up to the third floor. This work is shown in the photograph of Dec. 1, 1923, where the concrete work is complete with the exception of the penthouses, and the brick work has been carried to the ninth floor.

On Jan. 1, 1924, the exterior of the building was complete with the windows in place, and the boiler plant had been entirely installed by about the first of December, so that heat was furnished for the interior work which was progressing rapidly at that time.

On Dec. 1, 1923, until the hotel was opened on June 17, 1924, the real

Starting Excavation on July 10, 1923, the Beginning of a Record-Breaking Project.

On Dec. 1, 1923, With Concrete Work Nearly Complete and Brick Work up to Ninth Floor.

work of coordinating the installation of materials such as plaster, interior woodwork, marble and tile, plumbing, electrical fixtures, ventilating equipment and the refrigerator system, was in full swing. As mentioned above, the hotel was opened on June 17, 1924, just ten and a half months after the excavation was started. This meant the complete finishing of the job, including the installation of approximately a one-half million dollars worth of furniture, rugs, beds, linen, silverware and china.

The hotel has 600 bedrooms, all with adjoining baths finished in tile and marble. The sub-basement accommodates the boiler plant which consists of three 200-H. P. water tube boilers, together with the necessary pumping equipment and water system. The basement is devoted to a billiard room, barber shop, laundries, pastry and bread shops, a butcher shop and a cold storage refrigerator plant. The first floor accommodates the main dining room, kitchen, promenade and lobby, the latter, shown in the accompanying photograph, being wainscoted entirely in beautifully finished American walnut. There are on this floor also 19 stores available for rental purposes. The second, or mezzanine, floor is devoted to sample rooms, small banquet rooms and promenades surrounding the lobby. This floor also accommodates a ball room capable of seating 1,000 persons, together with a supplementary kitchen used for supplying the needs of the ballroom when it is used for large banquets. From the third to the thirteenth floor the building is devoted entirely to guest rooms.

Machinery for the six passenger elevators and the two service elevators is located in the two penthouses surmounting the roof. These penthouses also

accommodate the house tanks which supply the water for the hotel. Between the penthouses a radio broadcasting studio is provided for the use of the WCCO station at Anoka, Minn.

The exterior of the building presents an imposing structure in an English Renaissance style. The materials used are reddish brick with terra cotta and cut stone trim and base course, and in accordance with the trend of the times its general character is one of extreme simplicity. The architects have relied for interest upon form and silhouette rather than upon ornamentation.

The Lobby of the Nicollet, Wainscoted Throughout in American Walnut.

LEACHING-IN-PLACE OF COPPER

Process Increases Potential Value of Utah Mine

By Arvid E. Anderson, Lambda '20

Metallurgist, Ohio Copper Company

ELIMINATION of operation mining costs in the production of copper, the dream of metallurgists for years, is now demonstrated at the Ohio Copper Company's mine at Bingham Canyon, Utah, to be commercially feasible. Credit for the success of this enterprise is due to the persistence and good judgment of S. K. Kellock and F. E. Turner, pioneers in the development of a new method of extracting and producing copper.

Briefly, this process, leaching-in-place, consists of the natural conversion of the copper sulfide minerals to the water-soluble copper sulfate, dissolving this resultant mineral by percolating water through the ore body, collecting the copper-laden solution and precipitating the copper therefrom by additions of de-tinned scrap iron.

The chief copper mineral which sulfatizes in the ore body is chalcocite, which is of secondary origin and is associated with pyrite, chalcopyrite, and small quantities of bornite. Sulfatization is greatly aided by the presence of pyrite, and is probably due to the formation of the ferric sulfate which in turn dissolves one-half of the chalcocite, leaving the copper mineral, covelite, and forming the crystals of copper sulfate according to the reaction,

$$Cu_2S + Fe_2(SO_4)_3 = CuS + 2\,FeSO_4 + CuSO_4.$$

It is surprising to note the rapidity with which the minerals sulfatize. A newly-broken surface shows considerable sulfatizing after two weeks, and at the end of two months the walls are blue with a formation of copper sulfate crystals.

During the mining operations for the concentrating mill at Lark, large tonnages of low grade ore were caved into stopes and raises, these in turn leading to the main ore bins located above the tunnel level so that the ore could be loaded into mine cars by gravity flow and hauled to Lark. Operations ceased in 1919 when the price of copper declined and low milling recoveries were obtained due to the presence of oxide minerals; consequently a great amount of ore of too low a grade for milling was caved but not mined.

This leaching ore is estimated to contain from .3 to 1.3 per cent copper. The resultant broken area forms a porous medium for oxidation or sulfatization and the presence of pyrite, air and moisture causes the sulfatization to proceed rapidly. The copper minerals are deseminated through quartzite, so the decomposition or decrepitation of the rock does not interfere with leaching.

Percolation of the solution is done by applying about 1200 gallons of water a minute at the surface and since it naturally seeks places of least resistance, it percolates through the caved area, finding its way into the old raises and finally into the main ore bins from which it is carried in launders to the precipitation plant located about 1000 feet down the tunnel. The percolation through the ore body requires from 40 to 96 hours, during this time the solution increasing in copper content and passing through about 1000 feet of caved area. The large, blue copper sulfate crystals found are most readily soluble, while the less-pure matty crystals are not so readily soluble in water,

this in part accounting for the fact that water can percolate over a surface for several months without becoming barren of copper. For instance, on Nov. 1, 1923, water began coming through certain ore bins after being applied at the surface at a known zone. Daily samples of this water were taken and the average analysis for the month of November showed .605 per cent copper; for December, .317 per cent; for January, .223 per cent; for February, .170 per cent and for March, .140 per cent. These results are remarkable because they show that leaching-in-place is not a temporary process as one would naturally expect, but that as the solutions traverse a certain area it retains its tenor for at least several months. About 3000 square feet of the surface were covered in 18 months, producing 6,888,225 pounds of copper, and there remained a total of about 840,000 square feet to be covered in order to leach the caved area.

The average recovery obtained from the solution for the first quarter of 1924 was 95.83 per cent, producing a product which averaged 91.39 per cent copper. The highest lot shipped carried 95.14 per cent copper, this being the best grade of this precipitate ever shipped to any smelter. This wonderful precipitation was due to the construction of the precipitation plant, the velocity of the solution and the use of a pure grade of iron.

The plant consists of 3200 feet of launders, 1600 feet on each side of the tunnel. These are subdivided into sections, 320 feet to a section, and at the end of each section there is a syphon arranged so that the water can be diverted to either side when washing the copper into the settling chamber or when removing the copper for smelter shipments. These sections are in turn divided into boxes 16 feet long, 32 inches wide and 32 inches deep, constructed inside to prevent excessive leakage. About 17 inches from the base there is a false bottom consisting of a lattice work having openings about one-fourth inch square. The iron is placed upon this falsework, and after about eight hours of precipitation the cement copper is washed through into the settling chamber. The copper is removed about every ten days from the settling chambers by shoveling into specially constructed mine cars. These are then hauled about two miles and transferred into railroad cars for shipment to the local smelter.

Three shifts of 15 men each are necessary to keep the boxes full of detinned scrap iron, to wash the copper through the false bottoms into the settling chambers and to clean the boxes for shipment.

The launders have a one-half of one per cent grade which produces a velocity of about 40 feet a minute. De-tinned scrap iron obtained from the Pacific coast is used; it has a large amount of surface to expose to the action of the water and is exceedingly pure. One pound of iron produces about one pound of copper, this being due to the fact that the solutions which enter the plant contain very little free acid and ferric iron. A typical analysis shows 1,210 pounds of sulfuric acid, 2.49 pounds of iron and 15.173 pounds of copper in each 1000 gallons.

The operating cost of producing copper by this process during the first quarter of 1924 was 6.21 cents a pound of copper. The production in this period amounted to 2,532,106 pounds.

The question which is most frequently asked concerning these operations is, "How long will it last?" This is best answered by a report submitted by independent engineers after they had made a thorough and exhaustive study

and computation. Their report states that in the present caved area and open portion of the mines there is a total of 473,785,624 pounds of copper, of which they estimate that 70 per cent, about 331,000,000 pounds, is recoverable by the present method of leaching. If this is taken out at the rate of 12,000,000 pounds a year, the operations will continue for at least 25 years. In addition to this great and now valuable deposit, there is an extremely large area for the leaching operations yet undeveloped and a large and valuable tailings pile which contains an appreciable quantity of copper susceptible to this operation.

With the extremely low production cost of 6.213 cents a pound and the enormous resource of 331,000,000 pounds of copper, one may very easily figure the large potential value of the Ohio property.

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BROTHER PHILLIPS EXCELS IN ARMY

Omicron Charter Member Shoots his Way to Fame

By M. J. Hess.

We of Omicron and of Theta Tau have an alumni which the rest of the chapters might be interested in hearing about. This man has distinguished himself in a line which might not be strictly referred to as Engineering but which nevertheless deserves considerable commendation. We refer to Second Lieut. James F. Phillips, '22, a charter member of Omicron, and a member of Tau Beta Pi and Sigma Xi, honoraries.

During his college life, Brother Phillips was active in the military activities of the University, and was especially interested in the rifle team. During his senior year he was cadet major of the engineer R. O. T. C. and captain of the University rifle team, winning his letter in that sport. He won numerous medals for individual records, and his team won first place in the Corps Area match. He received his commission in the army about a year after his graduation, at a time when he was a candidate for the degree of Master of Science.

Since his entrance into the army, Brother Phillips has been literally shooting his way to fame. In the summer of 1924 at the annual rifle meet at Camp Perry, Ohio, he was the youngest member of the winning engineer team which won the match only after a two day battle with the marines, and then by only the slim margin of six points out of three thousand. This was the first year the engineers had entered a team, and because the marines had won five of the preceding six matches, the victory was quite a surprise to the spectators. Brother Phillips shot one of the highest scores on the team.

Somewhat earlier that year he gained recognition by shooting the highest score in a dual team match between a carefully selected United States team of eight men and the pick of Canadian riflemen.

On a recent visit to the campus, "Freddy" said that he expected to be transferred to the Philippines in the near future, but to date his address still is Fort Du Pont, Delaware.

OPERATIONS AT THE UNITED VERDE

Theta Tau Skill Supervises Operation Through

W. Val DeCamp, Gamma '08.

General Superintendent, United Verde Copper Co.

THE mines and surface plants of the United Verde Copper Company have received much attention of late in engineering and mining circles. This operation is now generally conceded to represent one of the most modern and efficient mining properties in the world. No small part of the success of this venture is due to the efforts of W. Val. DeCamp, '08 Gamma, who now is general superintendent of the company.

The United Verde Mine as originally located was a gold and silver producer only, and continued as such until 1889 when Senator Clark of Montana purchased the property. From that date until the present it has been one of the important copper producers of the country. In 1922 the mine produced 40,836,648 pounds of copper, 561,073 ounces of silver, and 13,049 ounces of gold. The dividends for this same year amounted to $1,350,000. These figures serve merely to give an idea of the magnitude of the operation, as the real interest to the engineer is centered in the methods of mining and treatment, and in the efficiency with which the various operations are carried out.

The orebody itself is an irregular mass of chalcopyrite which grades into pyrite on the hanging wall side and into schist on the footwall side. An important feature of the orebody is its persistance with depth. The ore lens is over 700 feet long and 150 feet wide at the 1,650 foot level. There are a number of small ore masses in the schistose footwall zone, and many of these have proved to be of considerable value.

The oxidized zone extends downward from the surface to a depth of 160 feet. This zone has proven particularly rich in gold and silver. The shallow levels were originally worked by the square set and fill method of underground mining. Numerous fires resulted in the abandonment of this system down to the 500 foot level, with the adoption of the open pit system. It was evident at this time that a complete reorganization of methods was necessary if the mine was ever to be developed to its fullest possible extent. The new smelter was placed at Clarkdale, a distance of eleven miles by rail from the mine, and the old surface plant at the mine was abandoned. In planning the new work, full consideration was given to the probable long life of the mine, and only the best and most permanent equipment was installed. The plant and underground equipment should therefore be of special interest to engineers.

After the reorganization, the mining operations fell into three distinct groups, the underground mining of the main orebody proper, the open pit working in the oxidized and shallow sulphide zone, and the underground mining of the small orebodies in the schist.

The life of the open pit operations is short as compared to the time necessary to exhaust the main orebody. It is estimated that two cubic yards of overburden must be removed for each ton of ore recovered. In the bottom of the pit, fifty-foot benches are carried.

The various levels are served by a standard guage track by means of a series of switch-backs. The track mileage in the pits total 8.6 miles. The ore is handled by three steam shovels, one being a Marion "300", long-boom revolving shovel, equipped with an eight cubic yard dipper. It can dump 56 feet above rail, and can cut a width of 200 feet at an elevation of 40 feet. The other two shovels are of the Osgood "120" revolving type. These shovels dump 19 feet above rail and can cut a width of 18 feet at an elevation of 74 feet. The Osgood shovels are mounted on caterpillar tractors. All machines are steam driven, and use fuel oil. The switch engines used are of two types, weighing 50 and 82 tons, respectively. The locomotives and dump cars are of the latest and most approved types. The drilling equipment for the surface work consists of three Keystone churn drills equipped with 2,000 pound tool strings and six inch bits. In addition to the churn drills, Sullivan DP331 rock drills are used for 20-foot toe holes and jack hammers for mill holing and bulldozing.

The underground development to date has reached a depth of 2,500 feet, although the lowest mining level is at 2,100 feet. One hundred feet is the interval level down to the 1,000-foot level, and 150 feet is the interval distance from there down to 2,000 feet.

The mine is served by two main adits, one at the 500 foot level for transporting supplies and men, and the Hopewell tunnel at the 1,000 foot level for moving the ore. The Hopewell tunnel is 7,000 feet long, and in section is 10x13 feet. It is equipped with a standard gauge track of 75 pound rails.

There are two three-compartment shafts for hoisting men and materials to the various levels from the tunnels, with two additional shafts which connect with the surface and are now used solely for ventilation.

The new 3,000-ton smelter was completed in 1915, but recent additions have brought its capacity up to 5,000 tons of ore per day. It consists of a crushing and sampling plant, calcining plant, blast furnace converter and reverberating departments, powdered coal plant, and a power house.

The smooth running of this great property, and the general spirit of cooperation manifested between the management and the workers speaks well for the general supervision of this operation, and Theta Tau is ably represented here in Brother DeCamp.

RESEARCH PROBLEMS AT LAMBDA

Subjects Include Geology, Metallurgy, Electricity, Hydraulics

By Ira A. Terry, Lambda '25.

Wasatch Range Studied By Ralph Gray

A STUDY of the Wasatch Mountains of Utah, with special attention focused on the fault scarp of its bold western face, has occupied the time of Ralph E. Gray, '21 Lambda, in the preparation of a master's degree thesis at the University of Utah. The magnitude of such a subject renders inadvisable an attempt to fully discuss it, so a few interesting and important items will be mentioned in order to show somewhat the line that the work followed.

Geographically, the Wasatch Mountains comprise two distinct and parallel ranges separated by depressions from four to ten miles wide. The eastern range is known as the Bear River range and the western part flanking the Salt Lake plain is called the Wasatch Front range, situated in the north central part of the state. The Wasatch fault scarp takes a northerly course beginning in the southern end of the range near the city of Nephi, Utah. Extending north some 150 miles, it seems to terminate at a point where the valley shifts to the east, and parallel ranges continue on into Idaho. This point is near the settlement of Collinston, Utah, and the section between here and Nephi has received attention in this study. The width of the range averages about 25 miles and is transversed by several steam-cut canyons trending generally in an east and west direction.

The Wasatch Front is a bold initial fault scarp, modified by erosion, rising abruptly from the plains. The crest line is well toward the western side, and when viewed from one of the highest peaks the range is seen to gradually slope from the crest line eastward at an angle of about 15 degrees, and westward at a much steeper angle. Following generally slopes of 15 degrees, which merge into those of 25 and then into 45, the crest line descends westward to the valley plains.

Longitudinally, the Front follows an irregular course with a series of "Cusp-bight," faulting being a prominent feature. This order of faulting seems to have had marked influence upon the location of the canyons and many hot mineral springs, the canyons appearing to be in that stage of development known as late maturity. Numerous small ravines and gulches, with steep gradients and rapids, are another characteristic of the country.

The present folding in the section under consideration is included in that of late Cretaceous time, and belongs to the period of diastrophism known as the Laramide. One notable feature of this folding is the syncline formation 18 miles long, situated in the central part of the range east of Salt Lake City. Its location is significant between Archian masses, to the north and south, because it seems to have had direct influence on the strike of the formation. Generally the formations show steep dip angles of 50 degrees and on up to the vertical.

Erosion followed this great uplift, resulting during the Eocene in the partial peneplantation of the surface and the deposition of the Wasatch Conglomerate, which in places attains thicknesses of 1,000 to 2,000 feet. The

large boulders of 50 to 75 tons grade into fine sediment constituting this rock, and together with their distance from the Algonkian rock mass they give interest to future study of this extensive Eocene deposit. The contact between the conglomerate and old surface of degredation is visible in many areas.

Following this erotional period, block-faulting (probably of the mid-Miocene age) gave rise to the present relief and initiated the Wasatch Fault scarp. Periodicity seems to have featured this development, and block tilting, advanced as an origin of many basin ranges, seems to be the explanation borne out by observations in the Wasatch Mountains.

Recent faulting is not hard to locate. North of Salt Lake a beautiful fault plane is exposed showing slickensides. This exposure is approximately 100 yards long and 50 feet high, showing a dip of 70 degrees toward the valley, and seems to line up with the earlier major movements.

The presence of hot mineral springs at the salients, projecting out into the valley, undoubtedly bear a relationship to the fault plane and cusping that has produced salients.

Lake Bonneville shore lines are conspicuous on the west face of the range, and measurements along these levels have cast some light upon the question of the mountain block having moved with reference to the valley block. However, difficulty arises in obtaining similar strand lines, so that the indications are not as decisive as they might be.

This brief summary will at least manifest the interest that is being taken by students of the University of Utah in this line of work. Brother Gray wishes only that time and money were available to give assurance that the study would be more extensively conducted. Students realize the difficulties of solving a geological problem in a period as short as a school year, especially since spring is the only time that very efficient field work can be done. Brother Gray trusts that those who read his research report will reap a little of the joy that has been his in pursuing such an interesting problem pertaining to the Wasatch Mountains.

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Bureau Work Under R. D. Bradford

THE metallurgical research department of the University of Utah, in co-operation with the Intermountain station of the United States Bureau of Mines, selected for the current year the subject of lead-silver hydro-metallurgy as one upon which research work should be conducted. The problem deals more specifically with chloride roasting and subsequent leaching of low grade silver lead ores with strong brine solutions, and the precipitation of the silver and lead as metal. R. D. Bradford, an alumnus of Lambda, research fellow in the department of metallurgy, has carried on the experimental work under the direction of University and Bureau of Mines technical advisors.

The solvent action of brine on ores of the above type has long been known. Several processes have been developed, and chief among these is that of Holt-Dern. It is upon some phases of this process that the research work was conducted. By this method the raw ore is crushed and mixed with about 10 per cent sodium chloride and enough fuel to generate sufficient heat so that when placed in a special type blast furnace the lead and silver are converted to chlorides. The hot roasted ore is then leached with a strong, slightly acid

brine, which takes the values into solution. They are then precipitated as follows: the silver goes down upon metallic copper; the solution is then passed over scrap iron, where the copper is released; and the lead goes from the solution onto finely divided scrap iron. The complete precipitation of the lead is the more difficult part of the process, and as possibly a better way, and one which would be more efficient, electrolytic precipitation has been tried.

During the course of the experimentation, a special type of electrolytic cell was developed. It has a thin wooden diaphram to separate the anolyte and catholyte and an insoluble carbon anode and a revolving sheet iron cathode. The revolving cathode prevents the evolution of hydrogen and makes possible the obtaining of a high current efficiency by vigorous agitation of the catholyte. After the lead has been deposited on the cathode, the barren solution is then sent through the anode compartment of the cell, where chlorine gas is formed and any iron that may be in solution is oxidized. The anolyte is then used as a solvent on the roasted ore.

Increased dissolving efficiency is effected by the use of the oxidized anode solution from the cell, rather than by the use of an unoxidized leach solution. From the experiments, it has been shown that the oxidized solutions will even to a large extent dissolve the silver and lead from the raw ore, thereby not necessitating the chloridizing roast. In case there are sulphide minerals in the ore, an oxidizing roast readily converts them into a soluable form.

Several large mining companies throughout the world are using this process, including the largest silver producers in the United States.

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Lava Subject of Christensen

CRATERS of the moon, an area of lava flows and cinder cones about sixty miles northwest of Pocatello, Ida., is the geological subject upon which A. Lee Christensen, '25 Lambda, based his senior thesis. The region shows signs of comparatively recent action, although, no doubt, there will be none in the near future. There is still hot water in the cones, and at times the whole region may seem to tremble and some vapors be emitted from the earth.

In some of the flows, large underground tunnels or caverns are of special interest. These are usually about 20 feet high and vary considerably in length. Of these tunnels, the largest is the Indian, it being about a quarter of a mile long. On the floors and walls of the tunnel are small patches of a fine white powder. This material consists largely of sodium carbonate and sodium sulphate. Brother Christensen is trying to explain the origin of these tunnels and the powder patches.

♠ ♠ ♠

A. C. Waves Are Shaped By Ira Terry

IRA A. TERRY, '25 Lambda, has been doing some work on the shaping of alternating current waves, both in the production and in their consumption, the latter being the more important of the two. In this work the reason for the generated wave taking the form that it does in several of the laboratory generators has been carefully analysed. The voltage from one of these generators was impressed upon several different types of circuits.

Oscillations, Thesis of Seth Pixton

HIGH frequency oscillations, especially as applied to radio, were the subject of a thesis by Seth Pixton, '25 Lambda. He came to some well founded conclusions, but his assertion that a knowledge of differential equations is necessary for a complete understanding of the problem prevents its discussion in this article in a way which would clarify the explamation.

♠ ♠ ♠

Ether Searched By Clyde Coombs

FINDING many things that were not supposed to exist, Clyde Coombs, '25 Lambda, has been doing some work that was not started as a research problem, but merely for the determination of some of the characteristics of vacuum tubes in connection with their application to the radio. He has gone out into the ether to see what he can find. Let's hope that he finds it but does not ask us to understand it when he gets it.

♠ ♠ ♠

Hydraulics Is Topic of Vernon Bell

VERNON BELL*, '25 Lambda, has been conducting a group of hydraulic experiments, and has ready for compilation a table of different coefficients and values that he has found to be of great importance in the field. By means of this table, a great deal of calculation and tabulation are eliminated in connection with hydraulic work. It is very valuable, and pertains more specifically to culvert volumes and flows.

*The editor recalls that Brother Bell accompanied Lambda's delegate to the 1923 Iowa City convention.

The GEAR *of* THETA TAU

OFFICIAL PUBLICATION OF THE FRATERNITY

ALBERT W. MORSE, ALPHA '26, EDITOR
2640 BLAISDELL AVENUE - - - - - - - MINNEAPOLIS, MINN.

PHIL J. LAURENCE, ALPHA '15, BUSINESS MGR.
1314 N. E. SECOND AVENUE - - - - - - - MIAMI, FLORIDA

VOLUME XV. FALL, 1925 NUMBER 2

THIS number completes Volume XV. The only other issue of the year was that of January. It was hoped that it would be possible to have four numbers, but this could not be done, and the work of the year has been consummated in this, the Fall Number.

♠ ♠ ♠

The most recent check on the positions and addresses of alumni appears in this number. While this list is by no means complete or final in its form, it is felt that its publication will be of general interest, and that it will help in the compilation in the near future of a complete directory of the fraternity. All Theta Taus, and others having the desired information, are urgently requested to assist the editor in securing data for this directory. Corrections of the list published at this time, additions to these records, and complete information about other alumni is earnestly desired.

♠ ♠ ♠

The old Nicollet Hotel was a landmark in Minneapolis, and Theta Taus who have been in the city famed for its flour mills no doubt remember the old structure. It is noteworthy that a Theta Tau, C. F. Haglin, Eta '13, figured prominently in building the New Nicollet, and his story of the progress of construction, published in this number, will be of interest to the engineer.

♠ ♠ ♠

Mining engineers are of course familiar to some extent with work at the Ohio Copper Company's mine at Bingham Canyon, Utah, and at the plant of the United Verde Copper Company. They will value the articles on these properties appearing in this number, one being written by Arvid E. Anderson, Lambda '20, and the other telling of the work of W. Val. DeCamp, Gamma '08.

♠ ♠ ♠

The fraternity is always glad to hear what Theta Taus are doing, glad to hear about their hobbies as well as their major activities. It is a pleasure to publish in this number an account of the achievements of James F. Phillips, Omicron '22, on the rifle team of the army engineers.

♠ ♠ ♠

Research studies of undergraduate Theta Taus at the University of Utah are mentioned in this number. The account will show members of other chapters what Lambda men have done in this line, and may recall to the minds of alumni the work of their undergraduate days.

♠ ♠ ♠

With another national convention at hand, it may be well to recall "Thoughts of the Sixth Biennial," being a group of paragraphs written by a number of delegates.

NATIONAL OFFICERS IN FRONT OF OMICRON CHAPTER HOUSE
Left to right: Erich J. Schrader, Prof. George D. Louderback, J. Sidney Marine, Phil J. Laurence, Prof. Jamison Vawter.

THOUGHTS OF THE SIXTH BIENNIAL

Hope of "Meeting you all again at Michigan" expressed.

ALPHA

Bernard Larpenteur

HAVING had the pleasure of attending the Sixth Biennial convention of Theta Tau, I feel that there is so much I would like to write about, that I hardly know where to begin. We were treated royally by the members of Omicron chapter, and are unanimous in our thanks for our hospitable reception at Iowa City.

In our business sessions, a great deal was accomplished systematically. Committees worked far into the night, discussing problems to be later brought up before the convention. The principal objective in everyone's mind was to make a better, stronger, and more unified fraternity of Theta Tau. Under the able guidance of our Grand Regent, Dr. Louderback, many valuable ideas and suggestions were given the delegates to carry back to their respective chapters.

My personal experience at the convention was one of the most profitable I have ever had. I had never fully realized the strength and character of our national organization. Usually we are in contact with only the brothers of our particular chapter, and we have very little actual

and tangible relationship with the members of other chapters, except through occasional visits by individuals.

It is a shame that every member of our fraternity couldn't have been there and have associated for a few days with the brothers from all corners of the country. I feel certain that every one would have had the same reaction that I did. We are members of a mighty organization of the highest ideals, composed of real men, all striving toward a common goal. May all future conventions be as successful, and do as much good toward unifying and strengthening our fraternity, as the past one.

—BERNARD LARPENTEUR.

♠ ♠ ♠

LAMBDA

George B. McLeese

IT is always a very pleasant experience and a cherished memory one has in meeting a group of real men. After the first pleasant sensation of brushing up against them, all that is left is the memory that often lasts forever.

The true quality of a fraternity is judged without error by the quality of its members. Theta Tau is a fraternity of the highest type, and any one attending the Sixth Biennial convention at Iowa City and meeting the finest "bunch of men" in the world, would heartily endorse that statement. Yes, I say the finest bunch of men in the world, and I mean it. Every one included, from old "Alabam'" to "Cast Iron" Johnston of Michigan, and from "Galoshes" Jagger of Boston to Hazzard of California. One could never ask to meet a finer bunch.

The convention and the many incidents during the course of its sessions will be forever remembered by all. The hospitality shown by Omicron chapter could hardly be beaten by any chapter, not even the "best." Too much praise can't be given to John and his splendid chapter for their continued efforts in making it comfortable for the visitors.

In closing, I want to assure the delegates and especially the resolution committee that "fire shovel"* will be used diligently in keeping the "fire of friendship" burning with the hope of meeting you all again at Michigan at the next convention.

—GEORGE B. MCLEESE.

*The editor might explain that a shovel was presented to Brother McLeese by the Convention, presumably that he might better fortify his position that Lambda was the best chapter.

MU

A GROUP of older men vitally interested in a product of their unselfish work, Theta Tau. They won my respect.

A group of young men earnestly endeavoring to help the fraternity national, and their own chapters, by sincere and conscientious attention to business.

A better "bunch" of sportsmen I will never meet. How about it, Mac of Michigan, and you men of Iowa, who were such generous hosts?

The convention filled me with a desire to help my chapter in every way possible. —THOMAS NEWTON.

♠ ♠ ♠

NU

Thomas N. Griggs

ONE December morning, Nu chapter started me away from Pittsburgh, the home of steel, steins, and sports. I was in a rather perturbed state of mind, as I had never attended a Theta Tau convention before. Well, I concluded that if all the chapters were as good as Nu, things would be heavenly. (Lambda publications please copy.) With such reflections, my peace of mind was assured. Things were rather uneventful until I hit Chicago. Thank heaven I am an innocent chap, although nurtured in the heart of the Smoky City. However, I reached the Rock Island depot in time to attend an informal meeting of Theta Taus which was held on the train.

At last we reached Iowa City, and were royally received and escorted up to the chapter house. As someone grabbed my suitcase and propelled my into an auto, I thought, "Gee, if the gang could only see me now." I never got service like that in Pittsburgh. In fact I blame Omicron chapter for educating me to luxurious habits. However, they made me feel at home, as I wasn't in the house ten minutes before they bummed all my cigarettes. I was immediately convinced that human nature is the same the world over. Before long I was pretty well acquainted, and thought that the other chapters were pretty nearly as good as Nu. Then a conceited bird from Lamb-

da came out and said that Lambda was the best chapter. I soon learned that the directors were hounds for work, and found that I had little spare time. What I did have was spent in going down to the Western Union with the Eta delegate while he sent wires to "someone." Seems like I made that trip ten times a day. And me a woman-hater!

It seems only fitting and proper that I devote an entire paragraph to the New Year's party. Those Omicron boys sure lined up a crowd of damsels with rapidity. More power to them! Everything worked out smoothly except that one of the boys committed a bad break before we started out. Due to climate conditions, (Michigan, you should get this one) the party was very successful, without the excessive hilarity that usually marks a New Year's party. Everyone seemed to be enjoying it immensely, and I know darn well that I did. Guess Alabam' and Columbia aren't the sheiks though!

All too soon the convention was over. It seems a crime that that identical gang will never reassemble. It also seems a crime that the next convention will not be held in Pittsburgh. That was a grevious error. However, if any Theta Tau comes within a hundred miles of Pittsburgh and doesn't call on Nu chapter, there will be —— to pay. We'll be looking for you birds that were out at the convention to pay us a visit, so come across.

—Thomas N. Griggs.

♠ ♠ ♠

PI

It is, I find, a rather difficult operation to give one's impressions of an event of the past. However, I think the one which was most vividly impressed on my mind is the awful comparison of climatic conditions in Iowa City and the Sunny South. I have an idea the preceding letter will have expressed the same impressions, so I think that one fact is well before the minds of our brothers.

To revert to the serious side of my impressions, the organized and ceremonious manner in which the whole convention was enacted impressed me a great deal and inspired me to make Theta Tau mean a great deal more at Virginia than it formerly did. Since I belonged to a new chapter, I for one was not able to realize what a great fellowship Theta Tau is. Now, after attending the national convention, I can more readily understand what it stands for and what its ideals are. —Harry K. Vought, Jr.

OMICRON

John S. Holbrook

AS Omicron chapter's delegate to the recent convention, it was my pleasure to act, after a fashion, as official host. This pleasure was only slightly dimmed when, as the only member of Omicron staying in the house, it fell to my lot to crawl out of a cool bed in a very much cooler outside world, and build a fire from dead ashes in order that our guests might arise without fear of being frozen before they could get dressed. Our weather was ordered especially so that "Alabam'" could see some real, honest-to-gosh winter, and I believe he appreciated it more than most of us. The nightly parade to the dormitory resembled very much a party of explorers setting out for the arctic regions, and the only reason Sid Marine didn't have on any more sweaters was because he brought just two or three with him.

From the foregoing, it might seem that the untimely blizzard was the only thing of importance that happened during the convention, and as a matter of fact, with the exception of the actual business meetings and our impromptu but none the less joyous New Year's dance, that seemed to me one of the most striking events. However, I shouldn't overlook the Revere-like performance of courageous Editor Morse, who braved the elements and made a thrilling trip from Iowa City to Cedar Rapids and back in an open "boat" in order that the "Gear" might reach the convention on time.

After it was all over, and the last of our visitors had taken his departure, we of Omicron sat back with a sigh of mingled relief and regret, and with an immense feeling of pride in this fraternity of Theta Tau. We appreciate keenly the fact that in spite of our youth and inexperience we were allowed the privilege of entertaining this convention, and we hope that we may not have to wait too many years before we can again have that pleasure.

— JOHN S. HOLBROOK.

THETA TAU ALUMNI DIRECTORY

Alderson, George E., Delta '09; Asst. Gen'l Supt., Federated Metals Corp., care Federated Metals Corp., Pittsburgh, Pa.

Ambler, Harry A., I '17; Chief Chemist, Superior Portland Cement Co., care Superior Portland Cement Co., Concrete, Wn.

Amsbary, Frank C., Jr.

Anderson, Avrid E., Lambda '20; Chemist and Metallurgist, Ohio Copper Co., care Ohio Copper Co., Lark, Utah.

Anderson, Ivan L., Lambda '22-'23; Mechanical and Structural Designer, Am. Smelting & Ref. Co., 434 Kensington Avenue, Salt Lake City, Utah.

Anderson, Marshall P., Mu '23; Engineer, Stone & Webster, Inc., Box 1040, Columbus, Ga.

Anderson. Raymond M., Omricon; Member, J. A. Anderson Hdwe., care J. A. Anderson Hdwe., Olds, Iowa.

*Ashton, James J., 230 So. 19th St., Bessemer, Ala.

Askew, Thomas A., Jr., Alpha '16; Manager, Thomas Askew Co., care Thomas Askew Co., Plainview, Minnesota.

Baldwin, Howard L., Lambda; Asso. Prof. Civ. Eng., Univ. of Utah, Univ. of Utah, Salt Lake City, Utah.

Barnes, Charles D., Lambda '20; Asst. research Chemist, Utah Oil Refining Co., Newhouse Bldg., Salt Lake City, Utah.

Barrett, George N., Jr., Delta '21; Metallographist, Park Drop Forge Co., E. 79th and N. Y. C. Tracks.

Barton, Joseph C., Iota '17; Gen. Mgr. Kansas Explorations, Inc., Subsidary St., Josaph Lead Co., Cosgrove Bldg., Joplin, Mo.

Batson, Charles D., Minnesota '07; Local Manager, Republic Creosoting Co., P. O. Box 310, Mobile, Ala.

Bemis, Edwin L., B '18; Chief Engineer, Wisconsin Steel Co., care Wisconsin Steel Co., Nashwauk, Minn.

Bergsland, Grant C., Alpha '23; Master Mechanic, Wis. Ry. Lt. & Pr. Co., care Wisc. Railway Light & Power Co., La Crosse, Wis.

Bever, Clarence A., Delta '13; Roll Engineer, The Otis Steel Co., care The Otis Steel Co., Cleveland, Ohio.

Billick, Don C., Epsilon '13; Consulting Engineer, 15 Avenue 42, Venice, Calif.

Blackall, Frederick S., Jr., Eta '22; Asst. Manager, Taft-Pierce Mfg. Co., care Taft-Pierce Mfg. Co., Woonsocket, R. I.

Borden, Granville S., Univ. of Calif. '18; Valvation Mining Engineer, U. S. Treasury Dept., Bureau of Internal Revenue, Washington, D. C.

Bridges, Terrell S., Beta '24; Transitman, Tenn. Coal, Iron & R. R. Co., Muscoda Office, Bessemer, Ala.

Brister, Charles M., Jr., O '14; Asst. Supt. Tank House, U. S. Metals Refining Co., care U. S. Metals Refining Co., Carteret, N. J.

Brown, Walter R., Gamma '10; Chief Eng., Min. Dept. Nev. Con. Cop. Co., care Nevada Con. Cop. Co., Ruth, Nevada.

Brunner, Donald G., Alpha '24; Asst. Engineer, Idawa Gold Mining Co., care Idawa Gold Mining Co., Quartzburg, Idaho.

Brussolo, Vito., Epsilon '20; Engineer, Calumet & Ariz. Min. Co.; care Calumet & Ariz. Min. Co., Lowell, Arizona.

Buck, Fred W., Minn. '09.

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* Addresses appearing after asterisks were sent in by men other than those named, and complete information was not given. The list as a whole is by no means complete, and its form is not final, the object of its publication being to make available to the fraternity the most recent check on addresses and to assist in issuing a complete directory at an early date. Alumni and undergraduates are urged to send, without delay, corrections and more complete information to the editor.

Budde, Otto C., '12; Teaching, Cleveland Heights Schools, Roosevelt Junior High School—Lee Road C. H.

Buell, Edward J., Delta '17; Sec'y-Manager, Niagara Wire Weaving Co., Ltd., care Niagara Wire Weaving Co., Ltd., Niagara Falls, Ontario.

Burris, Samuel J., Jr., Golden '15.

Burt, Curtis F., B '13; Cananea Cons. Copper Co., Cananea, Sonora, Mexico.

Cameron, Charles B., Beta '10; Superintendent, T. C. I. & R. R. Co., R. F. D. No. 1, Box 347, Birmingham, Alabama.

Cameron, C. B., R. R. 1, Birmingham, Ala.

Camp, Orton P., M. I. T., '15; The Platt Bros. & Co., care The Platt Bros. & Co., Waterbury, Conn.

Campbell, Henry W., '22; Engineer, Toledo Furnace Co., care Toledo Furnace Co., Toledo, Ohio.

Campbell, Jack P., Iota '24; Assistant City Engineer, City of Mexico, Texas, Box 586, Mexico, Texas.

Cannon, Abram H., Lambda '21; Field Engineer, International Smelter, care International Smelter, Tooele, Utah.

Carpenter, Donald F., MIT '22; Gen. Manager, B. G. Carpenter Co., care B. G. Carpenter Co., Wilkes Barre, Pa.

Chaffin, Charles E., Beta '13; General Engineering Co., 50 Broad Street, New York City.

Chapman, Theron, T '25.

Chapman, Wendell Phillips, L '14; Asst. Const'n. Eng'r., Minnesota Highway Dept., 1246 University Ave., St. Paul, Minn.

Christie, Laurence Glenn, Epsilon '20; Geologist, Roxana Petroleum Corp., 543 First National Bank Bldg., Houston, Texas.

Churchill, Harry DeWard, Delta '15; Asst. Professor, Case School of Applied Science, 13438 Hartford Rd., East Cleveland, Ohio.

*Clardy, Elgin F., care Ralston Purina Co., St. Louis, Mo.

Clendenin, Thomas P., Theta (Columbia) '21; Geologist, Amer. Smelt. & Ref. Co., 1112 Mills Building, El Paso, Texas.

*Cole, Lawrence, U. S. Metals Rep. Co., Carteret, N. J.

Conrad, C. L., '22;

Cornelius, Paul D., Z '22; Sales Engineer, Sullivan Machinery Co., 582 Market St., San Francisco, Calif.

*Corroll, W. F., 635 N. Isabel St., Glendale, Calif.

Cortis, Robert P., Kappa '23; Struct. Designer, Holabird & Roche, 1400 Monroe Bldg., Chicago, Ill.

Cowie, Leland Kinsey, Eta '22; Asst. Supt., Sou. Mang. Corp.—Fed. Phos. Co., care Fed. Phos. Co., Anniston, Ala.

Curtis, Thomas H., Alpha '12; Private Practice-Civil Engineering, Assoc. City Engineer of Fairmont, Fairmont, Minn.

Curtis, Verne F., Alpha '22; Asst. Mech. Engr., City of Minneapolis, 203 City Hall, Minneapolis, Minn.

Cutter, Paul F., '18; Mineral Inspector, U. S. Dept. of Interior, 616 Post Office Bldg., Portland, Ore.

*Daume, L. E., Box 1833, Jerome, Ariz.

Davis, Elmer F., Epsilon '10; Chief Geologist, Shell Company of California, 401 Higgins Bldg., Los Angeles, Calif.

Davis, Gilmore S., '15; Gen. Mgr., The O. L. Davis Lbr. Co., care The O. L. Davis Lbr. Co, Trinidad, Colo.

DeCamp, Wm. V., Gen Supt., U. V. Cop. Co., care U. V. Cop. Co., Jerome, Ariz.

Denison, Horace W., (M. I. T.) '19; Industrial Engr., Lopworth Webbing Co., care Lopworth Webbing Co., Stoughton, Mass.

Devlin, Frank W., Theta '25; Production Dept., Curtiss Airplane & Motor Co., Inc., care Curtiss Airplane & Motor Co., Inc., Garden City, L. I., N. Y.

Diemer, Clarence P., Delta '15; Asst. Supt., Champion Rivet Co., Harvard and E. 108th St., Cleveland, Ohio.

Dietrich, Neff T., Delta '23; Mech Eng., The Midland Steel Prod. Co., Madison Ave. and W. 106th St., Cleveland, Ohio.

Dodge, Charles H., Kappa '24; H. C. Frick Coke Co., Box 150, Edenborn, Pa.

Dorr, William R., Alpha '14; Organist and Choirmaster, Wilshire Presbyterian Church, Gamut Club Fipe Organ Studios, Los Angeles, Calif.

Doten, Everett F., M. I. T. '19; Detroit Representative, Stedman Products Co., 1217 Book Bldg., Detroit, Mich.

Drew, Chas. W., A '18; Salesman, Henry L. Doherty & Co., 611 Met. Bank Bldg., Minneapolis, Minn.

Duke, Otto, Lambda '22; Draftsman, Utah Power & Light Co., 133 So. W. Temple, Salt Lake City, Utah.

Earling, Roy B., B '08; Asst. Genl. Mgr., Hammon Consolidated Gold Fields, care Hammon Consolidated Gold Fields, Nome, Alaska.

Edward, Harrison S., Beta '11; Manager, Combined Metals Red. Co., 224 Felt Bldg., Salt Lake City, Utah.

Ed, Walter S., Alpha —; Gen. Salesman, Standard Oil Co., Ind., care Standard Oil Co., Ortonville, Minn.

Elfstrom, Axel E., Alpha '11; Asst. Arch. Engineer, City of Oakland, Bldg. Dept., City Hall, Oakland, Calif.

Endacott, Paul S., Zeta '23; Engineer, Phillips Petroleum Co., care Phillips Petroleum Co., Bartlesville, Okla.

English, Walter A., Geologist, Standard Oil Co., care Standard Oil Co., Taft, Calif.

Etter, Harold P., M. I. T., '20; Asst. to Dist. Mgr., Air Reduction Sales Co., 115 Plum St., St. Louis, Mo.

*Farf, Wm. M., care Walwont Mfg. Co., 42 Carolina St., Buffalo, N. Y.

Ferris, Albert L., Beta '11; Supt. Conjuro Mine, Shannon Copper Co. de Mex., care Shannon Copper Co., Chalchihuites, Zac., Mexico.

Fettke, Charles R., Nu '10; Assoc. Prof. of Geology, Carnegie Institute of Tech. Geology, care Carnegie Institute of Tech. Geology, Pittsburgh, Pa.

Fields, Howard H., Alpha '13; Ore Purchasing Agent, A. S. & R. Co., El Paso Smelting Works, El Paso, Texas.

Fleming, William H., Eta '16; Mgr. Nat'l Control Dept., The Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, Ohio.

Foley, Lyndon L., A '18; Geologist, Wrightsman Petroleum Co., Box 462, Tulsa, Okla.

Fopeano, Louis C., '21; Plant Metallurgist, Chile Exploration Co., Choquicamata, Chile, South America.

Fox, Paul S., Z '20; Chief Engr., N. M. Bureau of Pub. Health, Box 750, Santa Fe, N. M.

Frank, Harry O., Alpha '20; P. O. Box 236, Fairview, Mont.

Freeman, Harley L., Delta '17; President, The Industrial Machine Co., 1432-38 E. 47th St., Cleveland, Ohio.

Frisbie, Donald B., Delta '11; Southern Manager, Barber Greene Co., 1021 Healy Bldg., Atlanta, Ga.

Fry, Laurence L., O '25; Elect. Eng., Sac County Electric Co., care Sac County Electric Co., Sac City, Iowa.

Fugman, Victor C., Delta '10; Engr., National Lamp Wks. of G. E. Co., care National Lamp Wks. of G. E. Co., Nela Park, Cleveland, Ohio.

Furber, Pierce P., Steel Products, P. O. Box 339, Jacksonville, Fla.

Ganzenmueller, Carl H., '17; Engineer, United States Gypsum Co., 205 W. Monroe St., Chicago, Ill.

Gatts, William P., Iota '23; Chief Chemist, Wallace Pencil Co., care Wallace Pencil Co., Maplewood, Mo.

Gedney, Kenneth H., Zeta —; Architect, K. H. Gedney Co., care K. H. Gedney Co., Hastings, Nebr., and Kansas City, Mo.

Geis, Wilfird H., Epsilon '15; Director, Consolidated Royalty Oil Co., Consolidated Royalty Bldg., Casper, Wyo.

Gettler, Warren R., '22; City Engineer, City of Hannibal, City Hall, Hannibal, Mo.

Gillette, Welby E., Delta —; Secretary, Ferbert-Schorndorfer Co., care Ferbert-Schorndorfer Co., Elmwood Ave.-Berea Rd., Cleveland, Ohio.

Goetzenberger, Ralph L., Alpha '14; Mechanical Engr., Ordnance Dept., U. S. A., Frankford Arsenal, Philadelphia, Pa.

Granfield, Thomas H., Alpha '14; Engr. Costs & Practices, N. W. Bell Tel. Co., 804 Telephone Bldg., Omaha, Nebr.

Green, John Russell, K '22; Sales Engineer, Brown Instrument Co., 215 E. New York St., Indianapolis, Ind.

*Greib, George A., 656 Collins Ave., Miami Beach, Fla.

Groselle, John F., Delta '17; Designer, White Motor Car Co., care White Motor Car Co., Cleveland, Ohio.

Hagerman, Oliver S., Alpha '18; Asst. Engr., American Light & Traction Co., 120 Broadway, New York City.

Haglin, Charles F., Eta '13; Vice Pres., C. F. Haglin & Sons Co., 226 Lumber Exchange, Minneapolis, Minn.

Hains, Donald L., O—; Inspector, Public Service Co., 10 Illinois St., Chicago Heights, Ill.

Hampton, Donald V., Delta '23; Osteopathic Physician, Cleveland, Ohio.

Hanks, Isaac B., Alpha '07; Capitalist, 702 Kahl Bldg., Davenport, Iowa.

Hardison, Harvey, Epsilon '21; Resident Geologist, Pacific Oil Co., Box 212, Coalinga, Calif.

Harrington, Thomas H., Theta '89; Assoc. Prof. of Drawing, Columbia University, care Columbia University, New York City.

Hartley, Will T., Delta '11; Chief Chemist, Atlas Steel Co., care Atlas Steel Co., Dunkirk, N. Y.

Hassenbring, Albrecht, B '06; Consulting Engineer, 612 Queen St., Soo, Ont., Canada.

Havens, Philip B., Beta '24; Sales Eng., Goodman Mfg. Co., care Goodman Mfg. Co., 48th & Halstad, Chicago, Ill.

Hawley, George L., Zeta '23; Chief Eng., United Power & Light Corp., 117 N. Main, Hutchinson, Kans.

Herbig, Rudolph O., Delta '19; Dist. Mgr., Reliance Elect. & Engr'g. Co., 431 S. Dearborn St., Chicago, Ill.

Herron, John C., Gamma '23; Salesman, Colonial Steel Co., 5-253 General Motors Bldg., Detroit, Mich.

Hersam, Ernest D., Epsilon '91; Prof. of Metallurgy, University of California, University of California, Berkeley, Calif.

Hess, Mark J., Omicron '25; Jr. Highway Engr., State of Ill., Spurling Bldg., Elgin, Ill.

Hewett, Maurice W., Alpha '13; Sr. Asst. Civil Engr., Dept of Public Works, care Dept. of Public Works, St. Paul, Minn.

High, Ralph B., California '12; Refinery Manager, New Orleans Refining Co., Inc., care New Orleans Refining Co., Inc., Sellers, La.

Holbrook, John S., Omicron '24; W. R. Grace & Co., 7 Hanover Square, New York City.

Holmes, John F., Beta '19; Mining Engr., Pickands Mather & Co., Plymouth Mine, Verona, Mich.

Houle, Albert J., B Mich. '96; Mechanical Engr., Moctezuma Copper Co., P. O. Box 19, Nacazori, Sonora, Mexico.

Hopkins, Herman H., B '08; President, H. H. Hopkins Co., 1724 W. Fulton St., Chicago, Ill.

Hubbard, William E., A '17; Division Geologist, Humble Oil & Rfg. Co., Drawer 1039, Wichita Falls, Texas.

Hulin, Carlton D., Epsilon '20; Asst. Prof. of Geology, Univ. of California, 102 Bason Hall, U. of Calif., Berkeley, Calif.

Humel, Arthur C., Beta '21; Estimator, Geo. Rackle & Sons Co., P. O. Box 347, Cleveland, Ohio.

Hurlkutt, Frederick L., Mass. Inst. of Tech. '15; Asst. Mgr., Patent Scaffolding Co., 1550 Dayton St., Chicago, Ill.

Jakobson, Irving D., Eta '21; Asst. Mngr., Jakobson & Peterson, Inc., care Jakobson & Peterson, Inc., Ft. of 16th Ave., Brooklyn, N. Y.

Jakosky, J. J., Kansas '20; Elect. Engineer, Western Precipitation Co., 1016 W. 9th St., Los Angeles, Calif.

James, Wallace McN., Zeta '25; Test Course, G. E. Co., 24 Washington Ave., Schenectady, N. Y.

*Janes, G. M., care Indep. Stone & Furnace Co., Independence, Mo.

Jensen, Cyril D., Alpha '21; Instructor, Lehigh University, care Lehigh University, Bethlehem, Pa.

Jevine, Geo. W., Alpha '10; Constr. Supt., Walker & Eisen, 1734 N. Wilcox, Hollywood, Calif.

Johnson, Gunnard E., Iota '16; Supt. International Lead Ref. Co., Supt., Anaconda Lead Products Co.

Johnston, Kenneth A., Alpha '21; Mining Engineer, Oliver Iron Mining Co., Box 172, Buhl, Minn.

Kaiser, Howard W., Delta '17; Sales Engineer, The Hughes-Limbach Co., 118 St. Clair Ave. E., Cleveland, Ohio.

Kappahn, Harvey E., A. of Minn., '19; Resident Engr. Wells Engineering Co., Court House, Geneva, Ill.

*Kennedy, Duane E., 6142 Dorchester, Chicago, Ill.

Kerr, John B., Epsilon '15; Consulting Geologist, 601 Balboa Bldg., San Francisco, Calif.

Kew, William S. W., '12; Geologist, Standard Oil Co., (Calif.), 529 Standard Oil Bldg., Los Angeles, Calif.

*Kilbourne, B. N., Col. School of Mines, American Smelter & Refining Co. Omaha, Nebr.

King, Everett E., Illinois; Prof. of Railway Civil Engineering, University of Ill., Urbana, Ill.

Kingsley, Kenneth C., Eta '23; Ind. Eng., L. A. Soap Co., 617 E. First St., Los Angeles, Calif.

Kittridge, Francis B., Eta '21; Engineer, Pittsburgh Construction Co., & Duquesne Slag Products Co., 812 Diamond Bank Bldg., Pittsburgh, Pa.

Kittredge, Raymond B., Omicron '06; Prof. Transportation Eng., State University of Iowa, Engineering Bldg., Univ. of Iowa, Iowa City, Iowa.

Klepetko, Ernest, Beta '11; Concentration Engineer, Anaconda Copper Mining Co., care Anaconda Copper Mng. Co., Anaconda, Mont.

Kline, Zenas C., Delta '10; Manager, Niles Glass Division of General Electric Co., care Niles Glass Division of General Electric Co., Niles, Ohio.

Klopsch, Otto Z., '22; Asst. Scientist, Bureau of Standards, care Bureau of Standards, Washington, D. C.

Kodet, Gustav, Delta '18; Draftsman, Peerless Motor Car Co., Engineering Dept., Peerless Motor Car Co., Cleveland, Ohio.

Kopper, Edward, Alpha '13; Partner, H. C. McNair Co., 343 Endicott Bldg., St. Paul, Minn.

*Kredel, F. G., 4813 E. 84th St., Cleveland, Ohio.

Kratz, Arthur M., '05; Mech. Engr., Cia Real del Monte, Pachuca,Hidalgo, Mexico.

Krose, Helmer V., L. of Minn., '14; Mech. Engr., U. V. Copper Co., care U. V. Copper Co., Jerome, Ariz.

Kruger, Herman A., Gamma '09; Construction Supt., So. Calif. Edison Co., care So. Calif. Edison Co., Big Creek, Calif.

*Krumm, G. A., Box 1833, Jerome, Ariz.

*Kuzell, Charles, Clarkdale, Ariz.

Larpenteur, Bernard J., Alpha '25; Tech. Asst., Minn. Mines Exp. Sta., U. of Minn., Mines Exp. Sta., Minneapolis, Minn.

Laurence, Phil J., Minn. Alpha '15; Engineer, National Const. Co., 1314 N. E. Second Ave., Miami, Fla.

Leake, Robert A., Mu '23; Asst. to Vice Pres., Big Sandy Coal & Iron Co., 908 Southern Railway Bldg., Birmingham, Ala.

Leeb, Henry L., Eta '15; President, Hardwick, Field & Leeb, Inc., 231 Murray St., Newark, N. J.

Leiser, Jesse B., Epsilon '21; Field Geologist, Roxana Petroleum Corp., care Geol. Dept., Rox. Pet. Corp., Ponca City, Okla.

Lerwill, Joseph R., Lambda '21; Mining Engr., Mutual Coal Co., Box 63, Rains, Utah.

Lewis, Wm. M., Gamma '09; Contracting Engr., Layne-New York Co., 315 Market St., Camden, N. J.

Lieber, George M., Delta '19; Deputy, County Surveyor, County Surveyor's Office, Fremont, Ohio.

Louderback, George D., Epsilon '96; Professor of Geology, University of Calif., University of Calif., Berkeley, Calif.

Luff, Elvin, Kenneth, Zeta '23; St. Louis Brch. Mgr., Independence Stove & Furnace Co., 5088 Egston Ave., St. Louis, Mo.

Lund, Jack V., Kappa '16; Consulting Eng., Parsons, Klapp, Brinckerhoff & Douglas, 110 2nd St. S., St. Petersburg, Fla.

Luplow, Walter D., Alpha '17; Army Officer, Corps of Engineers, The Engineer School, Ft. Humphreys, Va.

McDonald, Michael, Nu '23; Civil Engineer, New York State Engr., Pier No. 1, Foot Genessee St., Buffalo, N. Y.

McKeen, Wm. R., M. I. T. '21; Trust Dept., McKeen Natl. Bank, care McKeen Natl. Bk., Terre Haute, Ind.

McLaughlin, Donald H., Epsilon '14; Prof. of Mining, Eng., Harvard Univ., Rotch Bldg., Cambridge, Mass.

*McLaughlin, W. W., City Water Works Dept., Detroit, Mich.

McPherrin, Wm. Lane, M. I. T. '14; Agent, Kansas City Life Ins. Co., care Kansas City Life Ins. Co., Armour & Broadway, Kansas City, Mo.

MacDonald, Edmund John, Eta '21; John MacDonald Const. Co., 77 Summer St., Boston, Mass.

Machin, Edwin G., Iota '22; Supt. of Const., Indiana Road Paving Co., care Indiana Road Paving Co., Rochester, Ind.

Mahood, G. Phillips, Gamma '24; Eng. Dept., Bethlehem Steel Co., care Bethlehem Steel Co., Bethlehem, Pa.

Markson, C. O., Alpha '22; Resident Eng., Minn. Highway Dept., care Minn. Highway Dept., St. Paul, Minn.

Marshall, Emory M., Colo. Sch. Mines '11; Mining Engineer, 788 Mills Bldg., San Francisco, Calif.

Marshman, Irving H., Alpha '23; Patent Atty., General Electric Co., Legal Bldg., 157 "G" St. NW., Washington, D. C.

Matchett, Henry J., Alpha '13; U. S. Army Officer, 35th U. S. Inf., Schofield Bks., Hawaii.

Medding, Walter L., H '17; 1st Lt. C. E., U. S. Army, 13th Floor Custom House, Boston, Mass.

Melcher, Paul R., Beta '22; Engineer, New Jersey Zinc Co., care New Jersey Zinc Co., Franklin, N. J.

Merritt, Glenn W., Beta '22; Sales Engineer, Mining Safety Device Co., care Mining Safety Device Co., Bowerston, Ohio.

*Metz, John, Jerome, Ariz.

Metzger, Wm. H., Iota '22; Asst. Highway Eng., State of Ill. Div. of Highways, New Clifton Hotel Bldg., Ottawa, Ill.

Miller, Henry W., '07; Prof. Mechanism, University of Mich., University of Mich., Ann Arbor, Mich.

Miller, Robert F., Epsilon '20.

Mills, Harold F., Beta '14; Supt. South Ibex Mines, care South Ibex Mines, Leadville, Colo.

Milne, Rufus H., Alpha '14; Special Agent, Northwestern Mutual Life, care Northwestern Mutual Life, Hibbing, Minn.

Mitchell, Frederick R., Beta '17; Division Engr., Tennessee Coal, Iron & R. R. Co., Wenonah Mines, Bessemer, Ala.

Moodie, Dwight L., Iota '24; Engineer, Laclede-Christy Clay Products Co., care Laclede-Christy Clay Products Co., St. Louis, Mo.

Moore, John H., A '24; Safety Engr., Hartford Acc. E. Ind. Co., 1416 First N. Bk. Bldg., Cincinnati, Ohio.

*Moran, Jack, New Clifton Hotel Bldg., Ottawa, Ill.

Morgan, Frank Albert, U. of Cal. '20; Geologist, Petrol Eng. with E. A. Starke, 412 Security Bldg., Los Angeles, Calif.

Morgan, George H., Beta '08; Asst. Sales Mgr., Palos Verdes Estates, 501 Lane Mortgage Bldg., 8th & Spring Sts., Los Angeles, Calif.

Morrison, George A., B '04; Mgr. Twin State Used Car Exch., care Twin State Used Car Exch., Bellows Falls, Vt.

Morse, Albert W., Alpha '26, 2640 Blaisdell Ave., Minneapolis, Minn.

Morse, George H., Alpha '22, 2640 Blaisdell Ave., Minneapolis, Minn.

Morse, Roy R., E '13; Geologist, Shell Co. of Calif., 402 Higgins Bldg., Los Angeles, Calif.

*Murphy, Leo, Illinois Division Highways, Elgin, Ill.

Myers, John F., Colo. School of Mines '13; Metallurgist, New Jersey Zinc Co., care Empire Zinc Co., Canon City, Colo.

Nash, John C., M. I. T. '20; Hamlet Textile Co., 49 Church St., Pawtucket, R. I.

Naylor, Ralph E., Univ. of Ill. '22; New. Bus. Mgr., Southwestern Gas & Elec. Co., Box 1106, Shreveport, La.

Nicholson, Clyde W., Beta '16; Mining Engineer, Cleveland Cliffs Iron Co., care Cleveland Cliffs Iron Co., Ishpeming, Mich.

Nolte, Frederick W., XI '22; Purch. Agt., Wisconsin Valley Electric Co., 206 Third St., Wausau, Wis.

Ogilvie, Samuel J., Univ. of Calif. '17; Branch Mgr., Olds & Stoller Inter-Exch., 1612 W. Pico St., Los Angeles, Calif.

Orton, James W., Zeta '17; Designing Engineer Filtration, City of Detroit, Engineering Office, Waterworks Park, Detroit, Mich.

Osborne, Ernest L., M. I. T. Boston '14; Business Analyst, James W. Eadie, Jr., 141 Milk St.

Park, John, '17; Supt. Elkoro Mines Co., care Elkoro Mines Co., Jarbridge, Nev.

Pennebaker, Edwin N., Epsilon '24; Asst. Geologist, Cia Real Del Montey Pochuca, care Cia Real Del Monte, Pachuca, Hgo, Mexico.

Perkins, Lucius J., Kansas '21; Supervisor of Service, Brunswick-Balke Collender Co., 623-633 S. Wabash Ave., Chicago, Ill.

Phillips, James F., Omicron '22; Officer, U. S. Army, Lt. Phillips, Fort Du Pont, Del.

Pickard, Byron O., Beta '07; District Mgr., U. S. Bureau of Mines, care U. S. Bureau of Mines, Berkeley, Calif.

Pittser, Matthias, Colo. School of Mines, Athletic Coach, Miami University, care Miami University, Oxford, Ohio.

Plante, Thomas W., Nu '23; Furnace Foreman, Jones & Laughlin Steel Corp., Eliza Fces. Jol. Corp., Pittsburgh, Pa.

Raiff, Ben L., Colorado Mines '21; Assistant Supt., A. S. & R. Co., care American Smelting & Refining Co., East Helena, Mont.

Randall, Larcom, Alpha M. I. T. '21; Salesman, Atlantic Printing Co., 201 South St., Boston, Mass.

Ranney, Alfred Gardner, Eta '13; Member, Harris, Spaulding & Ranney, 808 Brady Bldg., San Antonio, Texas.

Reilly, John G., Iota '17; Supt. Araralo Mina, cia Real clal Monta y Pachuca, Pachuca, Hidalgo, Mexico.

Rich, Edmund G., Iowa Omicron '23; Coach (Football) Los Angeles High School, care Los Angeles High School, Los Angeles, Calif.

Risse, Robert F., Delta '23; Designer, Hadfield Penfield Steel Co., care Hadfield Penfield Steel Co., Bucyrus, Ohio.

Robinson, Harry A., Golden '17; President and Gen. Mgr., Robinson Motor Co., cor Merris & Pine Sts., Morristown, N. J.

Rogers, Harry T., Univ. of Ill. Charter Member '16; Asst. Eng. Bridge Dept., Illinois Central R. R., I. C. R. R., Bridge Dept., Chicago, Ill.

Rogers, Kenneth A., Beta '19; Mining Engineer, Montreal Mining Co., care Montreal Mining Co., Montreal, Wis.

*Roswell, W. Prouty, Riverside Portland Cement Co., Riverside, Calif.

Rounds, Charles K., Alpha '19; Chief Clerk Credit Dept., Minneapolis Genl. Elec Co., 15 S. 5th St., Minneapolis, Minn.

Russell, Richard J., Epsilon '19; Instructor, University of Calif. South Hall, University of Calif., Berkeley, Calif.

*Rutledge, R. Melvin, Kingman, Ariz.

Samson, Henry E., Zeta '16; Asst. Manager, City Light & Water Co., Box 330, Amarillo, Texas.

Satterley, Raymond D., Beta '25; Mining Engineer, Inland Steel Co., care Inland Steel Co., Ironton, Minn.

Schanze, August E., Beta '23; Leiutenant, U. S. Army, Ft. Crook, Nebr.

Schiermerer, Harry J., Iota '23; Division Engineer, Madison Coal Corp., care Madison Coal Corp., Glen Carbon, Ill.

Schlotter, Lawrence C., Beta '17; The First Trust & Savings Bank, Akron, O.

Erich J. Schrader, Alpha '05, Mining Engr., Box 244, Reno, Nevada.

Schucker, Paul F., Nu '24; Asst. Engineer, John M. Rice, Engineers, 411 Oliver Bldg., Pittsburgh, Pa.

Scofield, William D., Eta '24; Sales Agent, Rochester & Pittsburgh Coal, 350 New Scotland Ave., Albany, N. Y.

Settle, W. Caldwell, Alpha "Ex" '17; Asst. Supt. Ohio River Sand Co., 129 River Road, Louisville, Ky.

Sewall, Edward D., M. I. T. '17; Combustion Engr., Arthur D. Little, Inc.; 30 Chas. River Rd., Cambridge, Mass.

Seymour, Burleigh B., '21; Mining Eng., Benton, Ill.

Sheldon, Churchill G., Beta '16; Representative, Ingersoll Rand Co., care Ingersoll Rand Co., Houghton, Mich.

Shenon, Philip J., Epsilon '22; Instructor in Geol., Univ. of Minn., Geol. Dept., Univ. of Minn., Minneapolis, Minn.

Shotts, Claude C., Mu '25; Walker Mem. Bldg., M. I. T., Cambridge, Mass.

Shuttleworth, Richard R., Beta; Engineer, E. P. Lupfer Corp., 592 Elliot Sq., Buffalo, N. Y.

*Sinnard, M. F., care Independence Stove & Furnace Co., Independence, Mo.
Skinner, Henry C. T., Golden '24; Asst. Supt. County Bureau Highways, Princeton, Ill.
Skinner, Melvin B., '21; Asst. Genl. Sales Mgr., Horton Mfg. Co., care Horton Mfg. Co., Fort Wayne, Ind.
Smee, George, Zeta '17; Supt., R. H. Baldwin Paving Contract., 109½ E. Grand, Ponca City, Okla.
Smith, Arthur D., Jr., M. I. T. '23; Vice Pres., Geo. W. Smith Woodworking Co., 51st St. & Grays Ave., Philadelphia, Pa.
Smith, Donald C., Alphaminn '18; Engineer, Am. Tel. & Tel. Co., 195 Broadway, New York City.
Smith, Lyle W., Alpha '24; Sales Engineer, Sullivan Machinery Co., 511 Milk Bldg., El Paso, Texas.
Snow, Leslie W., Eta '14; Chase Securities Corp., 61 Broadway, New York City.
*Starbird, Roy, care City Assessor's Office, Long Beach, Calif.
Stevens, Hoy, Delta '22; Asst. to Vice Pres., Cleveland Railway Co., care Cleveland Railway Co., Hanna Bldg., Cleveland, Ohio.
Stevens, John G., Kappa '19; Treasurer, The Lindgren-Stevens Co., 1045 Gas Bldg., Chicago, Ill.
Stifel, Carl G., Rolla '16; Pres., Pocahontas Mining Co., Pres., Otto F. Stifel's Union Brewing Co., 3126 Gravois, St. Louis, Mo.
Stilwell, Edward H., Beta '11; Metallurgical Eng., Dodge Bros., care Dodge Bros., Detroit, Mich.
Stockham, Douglas Wm., of Ill. '21.
Strong, John L., Alpha '08; Mining Eng., Oliver Iron Mining Co., 614 Wolvin Bldg., Duluth, Minn.
Sweet, James R., Epsilon '24; Geologist Engineer, Minas de Matahambre-American Metals LF8d., Minas de Matahambre, Cuba; Pinar del Rio.
Teets, Charles W., Colo. '17; Metallurgist, Wilkinson Co., P. O. Box 303, Sonta Monica, Calif.
Templin, Richard L., Zeta '15; Chf. Engr. of Tests, Aluminum Co. of America, care Aluminum Co. of America, New Kensington, Pa.
*Thielicke, Charles, care La Moria Mine, Somberete, Zac, Mexico.
Thomas, Wallace S., M. I. T., '15; Treas., Thomas Mfg. Co., care Thomas Mfg. Co., Springfield, Ohio.
Thomas, William P., Eta '19; Continental Gin Co., Birmingham, Ala.
*Thornburg, Dwight H., care Geol. Dept., Rox. Pet. Corp., Dallas, Texas.
Thornburgh, Hubert R., Epsilon '22; Geologist, Roxana Petroleum Corp., Box 1865, Houston, Texas.
Timperley, Wm. D., Alpha '10; Sales Mgr., Crown Iron Works Co., 1229 Tyler St. N. E., Minneapolis, Minn.
Torbert, James B., Beta '07; President, Harlan-Wallins Coal Corp., care Harlin-Wallins Coal Corp., Pineville, Ky.
Udy, Gordon N., Delta Ex '20; Insurance Broker, A. N. Udy, 203 Royal Bank Bldg., London, Ontario, Canada.
Underhill, James, Mining Engr., Assoc. Prof. of Mining, Colo. School of Mines, care Colo. School of Mines, Idaho Springs, Colo.
Uren, Lester C., A. of Cal., '11; Assoc. Prof. Petroleum Eng., University of Calif., Mining Bldg., Univ. of Calif., Berkeley, Calif.
Van Valkenburgh, Robt. R., Beta '13; Mine Supt., Replogle Steel Co., care Replogle Steel Co., Wharton, N. J.
*Vogt, Leo, care Du Page County Highway Dept., Spurling Bldg., Wheaton, Ill.
Walker, Harlan A., Columbia '19; Supt. El Potasi Mng. Co., Apartado 13, Chihuahua, Mex.
Wall, Earle R., Epsilon '18; Geologist, Standard Oil Co., (Calif.), 225 Bush St., San Francisco, Calif.

Walling, Benjamin B., Alpha '09; Realtor, Ben B. Walling, 1046 McKnight Bldg., Minneapolis, Minn.

Warmuth, Philip L., Ohio '23; Engineer, Cook Electric Heating Co., 717 Frankfort Ave., Cleveland, Ohio.

Warner, Eldred E., Beta '25.

Webster, Vance H., Iota '23; Salesman, Embrey Development Co., 555 Broadway, Gary, Ind.

Weed, Stanley V., Beta Ex.; Chief Engr., Jarvis Engr. Wks., care Jarvis Engr. Wks., Lansing, Mich.

Weir, Kenneth J., Omicron '24; Draftsman, Pittsburgh-Des Moines Steel Co., 9th & Tuttle, Des Moines, Iowa.

Welker, George E., Beta '10; Vice Pres., United Natural Gas Co., and the Mars Co., 308 Seneca St., Oil City, Pa.

Wenk, Ralph W., B '10; Asst. Mgr., Andrews George Co., 50 Church St., New York City.

Wheeler, Walter H., Alpha '06; Engineer & Archt., Walter H. Wheeler, 1112 Met. Life Bldg., Minneapolis, Minn.

Whitman, Alfred Russell, Epsilon '11; Asst. Prof. Geol., Univ. Calif., So. Br., 855 Vermont Ave., Los Angeles, Calif.

Widmer, William C., Columbia University; Gen Mgr., Elmira Coal Co., care Elmira Coal Co., Elmira, Mo.

Wilkinson, Joseph R., Beta '14; Clerk, Berrien County Abstract Co., care Berrien County Abstract Co., St. Joseph, Mich.

Williams, Edward I., Columbia '14; Supt. of Smelter, Tennessee Copper Co., care Tennessee Copper Co., Copperhill, Tenn.

Williams, Othneil G., Eta '22; Chief Inspector, Gilbert Clock Co., 276 N. Main St., Winsted, Conn.

Willis, Cecil C., Zeta '22; Efficiency Eng., Okla. Gas & Elec. Co., care Okla. Gas & Elec. Co., Harrah, Okla.

Wilson, Frank L., '12; Accountant Engineer, Isaac Beers Co., Inc., 1475 Broadway, New York City.

Winchell, John H., Gamma '17; Manager, Puritan Pie Co., 2612 Champa St., Denver, Colo.

Witherow, Charles N., '23; Minn. Eng., Harbison Walker Ref. Co., care Harbison Walker Ref. Co., Blancburg, Pa.

Woodford, Alfred O., California '13; Teacher, Pomona College, care Pomona College, Claremont, Calif.

Woods, Rolland H., Gamma '25; Geologist, Humble O. & R. Co., Hotel Hamilton, Laredo, Texas.

Wright, Harris H., A '09; 207 Davidson Bldg., Kansas City, Mo.

Wright, Whitney B., Calif. '20; Field Manager, Fuller Brush Co., 1096 Pine St., Riverside, Calif.

Yeokum, George H., Zeta '17; Member, Gaines, Yeokum & Mackey Bridge Corp., 519½ W. Main St., Oklahoma City, Okla.

Young, Edward Francis, A '26.

Young, Yssel, Y., Zeta; Distribution Engr., United Power & Light Corp., care United Power & Light Corp., Abilene, Kans.

Theta Taus are Everywhere

ALABAMA

Alexander City—
JAMES H. WINGARD
Mu '22
Engineer
Dixie Construction Co.

ARIZONA

Jerome—
WILLIAM V. DE CAMP
Gamma '08
General Mine Superintendent
United Verde Copper Co.

CALIFORNIA

Venice—
DON C. BILLICK
Epsilon '13
Consulting Mining Engineer
15 Avenue 42

COLORADO

Denver—
ORLANDO G. McDONALD
Epsilon '23
Geologist
Roland Oil Co.

MASSACHUSETTS

Boston—
ROBERT J. ANDERSON
Delta '14
Consulting Metallurgical Engineer
P. O. Box 111, Fenway Station

MEXICO

Magdalena, Jalisco—
LINCOLN EHNBOM
Gamma '17
Stores Manager
Cinco Minas Company

MINNESOTA

Minneapolis—
WALTER H. WHEELER
Alpha '06
Engineer and Architect
1112 Metropolitan Life Building

NORTH CAROLINA

Davidson—
FRED COFFMAN
Lambda '22
Resident Engineer
W. H. Booker, Construction Engineer

OHIO

Cleveland—
CARL E. DAVID
Delta '17
Engineer
Bailey Meter Co.

OREGON

Portland—
PAUL F. CUTTER
Delta '18
Mineral Examiner
U. S. General Land Office

PERU, S. A.

Goyllarisquisga—
RALPH R. WIGGINS
Beta '14
Assistant Superintendent
Cerro de Pasco Copper Corporation

SOUTH DAKOTA

Lead—
ARTHUR B. YATES
Epsilon '22
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Homestake Mining Co.

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