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The
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VOL. XXIX

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NO. 2

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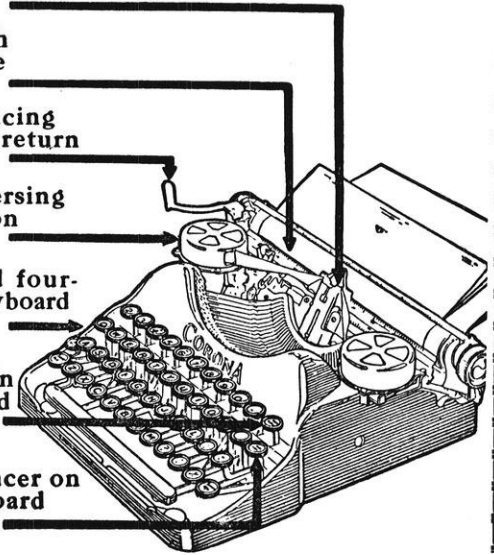
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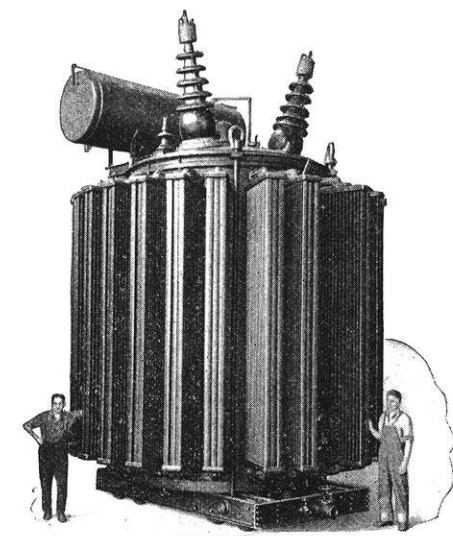
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THE CONSTITUTION OF IRON BLAST FURNACE SLAGS

By R. S. McCAFFERY

Professor of Mining and Metallurgy

THE Metallurgical Laboratory of the University of Wisconsin has for some time past carried on research work to determine the physical properties of blast furnace slags. To simplify the problem in the beginning we considered only those slags composed of silica, alumina and lime, but when the work was extended to include slags containing magnesia as well as the above three constituents we realized that we would have to make models to represent the slag composed of four constituents, as it was no longer possible to represent satisfactorily a four component system by means of a drawing in a plane and all blast furnace slags contain some magnesia.

Although blast furnace slags are composed ultimately of the four constituents—silica, alumina, lime, and magnesia, they are actually composed of compounds of these substances, some of the compounds containing two, some three and some four of these ultimate constituents. In all, there are seventeen compounds of silica, alumina, lime, and magnesia that enter into the composition of slags in addition to the ultimate constituents themselves or twenty-one in all, so that actually any slag may contain one, two, three, or four of these compounds or ultimate constituents. Table I is a list of these twenty-one components.

The problem then is to determine how these twenty-one different components go into solution, one in the other and what effect varying amounts of these components have on the physical and chemical properties of the slag.

Of the many possible types of solution, it happens that these twenty-one components form among themselves, solutions of only two types. One and by far the commonest type in slags is like the solution metallic lead and tin form with a eutectic at some intermediate composition, and the other type is like the solution of gold and silver which forms an isomorphous series. In the silica, alumina, lime, magnesia system, there are only two isomorphous series—the diopside—clinoenstatite or pyroxene series and the akermanite-gehlen-

ite or melilite series. All the others are of the eutectic forming type.

The system of four components, the sum of which is 100%, cannot be represented by drawings on a plane so that it was necessary to construct space models. The situation was somewhat simplified by the fact that all the binary systems in the four component systems CaO, MgO, Al₂O₃, SiO₂ formed either simply eutectic mixtures or isomorphous solutions. It is possible to use the equilateral tetrahedron to represent a four component system, for in such a solid, if perpendiculars are drawn from any point within to the four sides, the sum of these perpendiculars will be a constant.

TABLE I

1. Cristobalite	SiO ₂
2. Calcium bisilicate	Ca O SiO ₂
3. Anorthite	Ca O. Al ₂ O ₃ 2SiO ₂
4. Clino-enstatite	MgO. SiO ₂
5. Diopside	CaO. MgO. 2SiO ₂
6. Cordierite	2MgO. 2Al ₂ O ₃ 5SiO ₂
7. Sillimanite	Al ₂ O ₃ SiO ₂
8. Spinel	MgO. Al ₂ O ₃
9. Corundum	Al ₂ O ₃
10. Gehlerite	2 CaO. Al ₂ O ₃ SiO ₂
11. Madisonite (now)	2 CaO. 2MgO. Al ₂ O ₃ 3SiO ₂ (?)
12. Forsterite	2 MgO. SiO ₂
13. Akermanite	2 CaO. MgO. 2SiO ₂
14. Monticellite	CaO. MgO. SiO ₂
15. Periclase	Mg O
16. Calcium orthosilicate	2 CaO. SiO ₂
17. Tricalcium disilicate	3CaO. 2SiO ₂
18. Tricalcium aluminate	3CaO. Al ₂ O ₃
19. Pentacalcium trialuminate	5CaO. 3Al ₂ O ₃
20. Calcium aluminate	CaO. Al ₂ O ₃
21. Tricalcium pentaluminate	3CaO. 5Al ₂ O ₃

Using then the equilateral tetrahedron to represent the four component system CaO, MgO, Al₂O₃, SiO₂, the faces were constructed from the equilibria of the three component systems involved and the interior of the tetrahedron, was divided into tetrahedra of four component systems, the ternary eutectics were located on the faces of these interior tetrahedra and the quaternary eutectics were located inside each tetrahedron.

The complete model shows the spaces of composition of primary crystallization and from the location of the interior tetrahedra faces the approximate mineral composition of a slag of any composition can be determined.

Figs. 1, 2, 3, and 4 enclosed show the four faces of the CaO, MgO, Al₂O₃, SiO₂ tetrahedron, and Fig. 5 is a drawing to show the structure of the model.

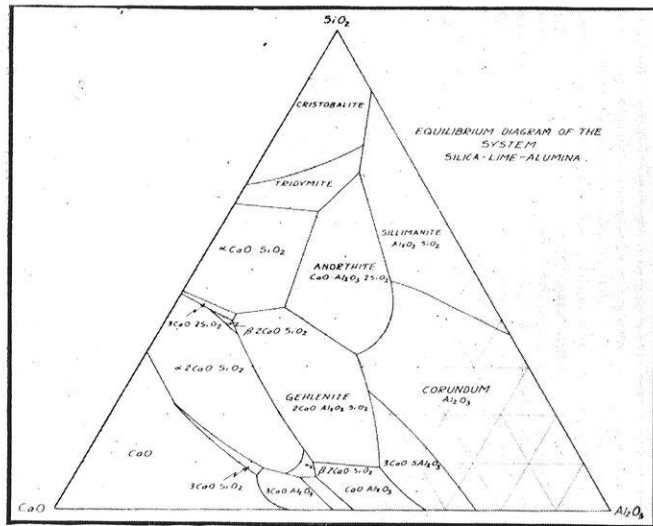


FIG. I.

Rankine & Wright. *Am. Jour. Sci.* 189-1

A great many interesting things were brought out by a study of the CaO, MgO, Al₂O₃, SiO₂ model. For example, all the authorities say that in considering blast furnace slags, the chemical equivalent in CaO of the MgO present may be added to the CaO present. This is totally and completely wrong for any slag which contains MgO, has a part of its composition, some of the magnesia minerals present, such as pyroxene, forsterite, akermanite, spinel or cordierite. The physical properties of these magnesia minerals are quite different from the non magnesia minerals in slags, say

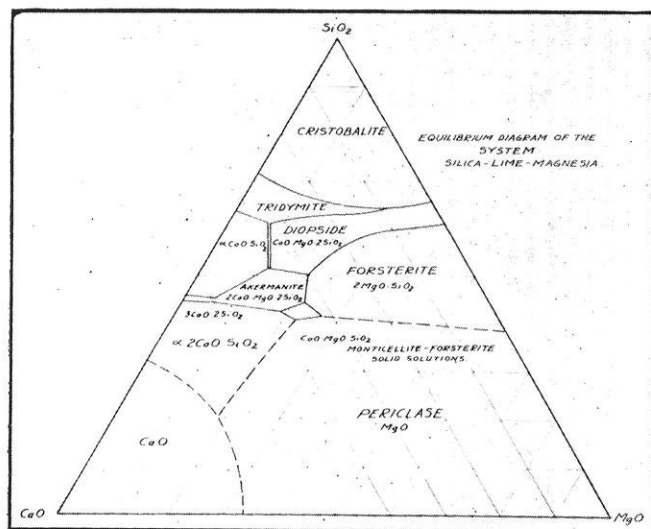


FIG. II.

Rankine & Merwin. *Jour. Am. Chem. Soc.* 38-568

calcium bisilicate, anorthite, gehlenite, calcium monosilicate or calcium sesquisilicate and it is immediately recognized that the addition of the chemical equivalent of the MgO to the CaO is incorrect.

There is another point clearly brought out by a study of the CaO, MgO, Al₂O₃, SiO₂ model. There are certain slag compositions that if used in the blast furnace give operating results that vary greatly if there is a comparatively small change in the ultimate composition of the slags. The reason for this is that any slag is composed of four and only four components or mineral entities and the physical properties of these components determine the physical properties of the slag. These slags are of such composition that a slight variation in the percentage of one or more constituents present, will change greatly the blast furnace operating results on slags, the composition of which is on or very near the boundary plane of the smaller internal tetrahedra. Being on or near this plane, a very small ultimate composition change would vary considerably the mineral composition of the slag and of course in so doing would vary its properties. This matter of critical slag composition has been checked over with some blast furnace superintendents, who agree in placing these critical ranges of composition where the space model indicates they are located.

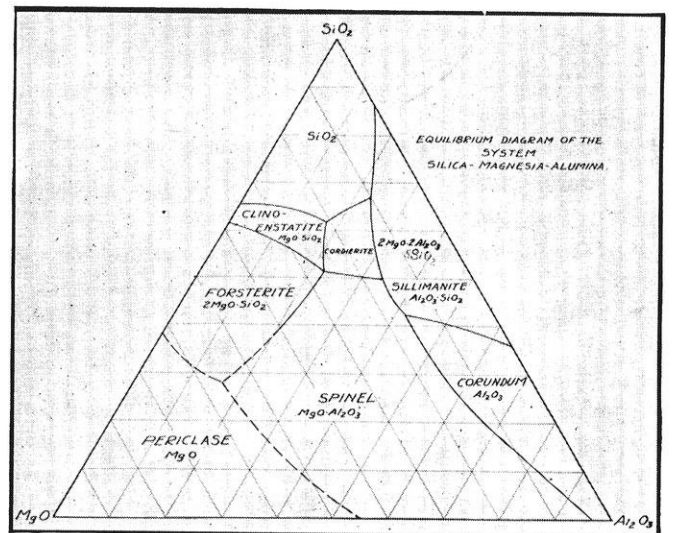


FIG. III.

Rankine & Merwin. *Am. Jour. Sci.* 195-301

To investigate the location of typical slags in the space model, another model on a larger scale was constructed taking in that part of the larger system that included the composition of all blast furnace slags and in this model were plotted a large number of American, English, French, German and Swedish blast furnace slags that were chosen to show the greatest possible variation in composition.

The slags so illustrated range themselves roughly into three groups; the silica, calcium bisilicate anorthite pyroxene type of charcoal furnace slag, the bisilicate anorthite gehlenite mellilite type of coke furnace slag

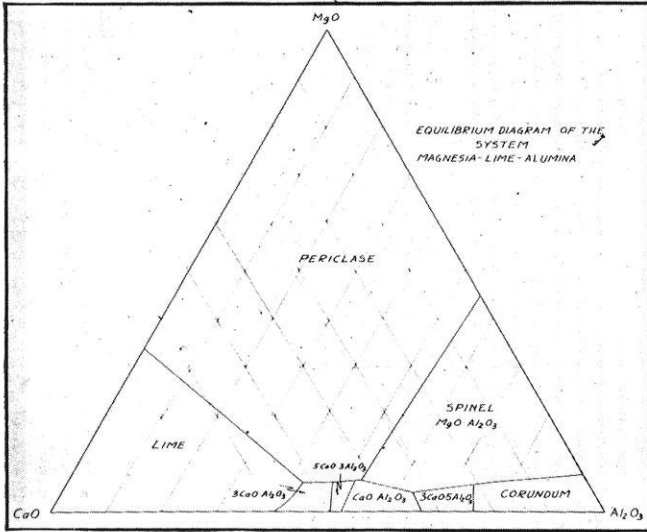


FIG. IV.

Ferguson & Merwin. *Am. Jour. Sci.* 198-81 and the gehlenite, anorthite akermanite Montecellite type of coke furnace slag. These three types, although they slightly overlap, show decided groupings into the one charcoal furnace type and the two coke furnace types. The reason why the practical furnace man avoids the two regions of composition where spinel and forsterite are primary crystallizations and of high melting points is also plainly shown.

The space model demonstrates forcibly the fallacy of the old idea which was, that the addition or subtraction of CaO or MgO or Al₂O₃ or SiO₂ to a slag had the effect of changing the properties of the slag because the properties of these four primary components were changed where as a matter of fact, a slag consists almost entirely of compounds of these primary components, and it is really the variation of the properties of these compounds that changes the properties of the slag. As the properties of the components are radically

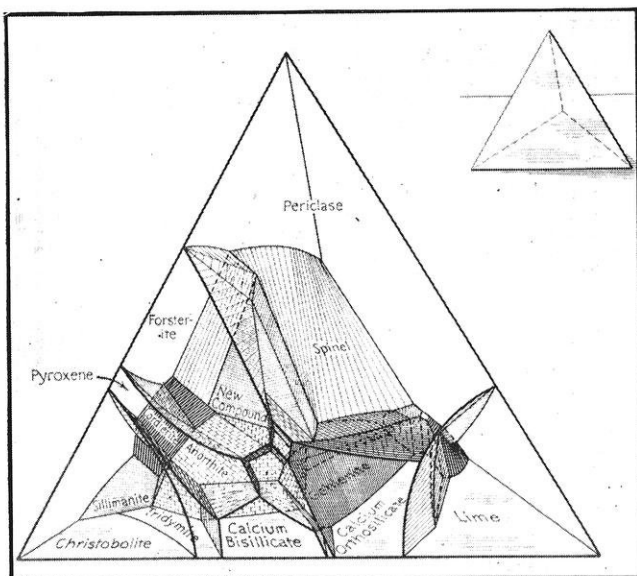


FIG. V. MODEL OF FOUR COMPONENT SYSTEM
SO₂ — CaO — Al₂O₃ — MgO

different from the properties of the compounds the disastrous result of reasoning based on the old notion is made very evident.

As a result of our study of the composition of blast furnace slags, we believe we have at last given a scientific explanation of their constitution that fits in with known facts, that is, in accordance with the latest ideas of physical chemistry, and which affords an easy and logical explanation for many things that had not been satisfactorily explained before. It also harmonizes many of the observations that had been made by furnace men which seemed till now, diametrically opposed to each other.

The fusibility or melting points of slags, the viscosity, the specific heat, the latent heat of formation and the solubility for sulphur are all properties which can be determined in the laboratory and, if known quantitatively for those compounds or mineral entities which compose slags, would afford the blast furnace operator the exact data on which to base his slag composition and afford means for the accurate determination of the most economic operation of the process.

CONCRETE AND MECHANICAL APPLIANCES

By A. H. GLADDEN '19

RESEARCH in the matter of concrete road construction is valuable only as its direct application may be made in modern practice. It is not advisable to theorize to the extent of becoming impractical, however it is well invested time and energy to work toward the end of practicing and commercializing the maximum amount of theoretical axioms. Research has shown us what our accomplishments have been and what they might be in the future. It has also shown the failures in a much more surprising number than the accomplishments. Research points out our faults, but does not always open up an avenue whereby these failures might be corrected.

Mr. G. W. Hutchinson, of the North Carolina State Highway Commission, in recent tests conducted by himself, shows conclusively a wide and varied range of results on crushing strength tests, all material being taken from the same job. It also bears out that the crushing strength varies widely even from cores drilled in close proximity to one another. Mr. A. T. Goldbeck, of the United States Bureau of Public Roads, admits this variation to be a characteristic which is not a local matter. Mr. Hutchinson experimented in over one thousand jobs and Mr. Goldbeck has possibly a much greater number. Therefore these conclusions should be fairly well proven.

Several reasons are advanced by concrete authorities for this occurrence.

1. Incorrect and careless proportioning of fine and coarse aggregates.
2. Non uniform consistency.

(Concluded on page 44)

THE PROPOSED MEN'S DORMITORIES

By ARTHUR PEABODY

Wisconsin State Architect

AMONG the important elements that differentiate the older Universities from State Institutions is the dormitory quadrangle.

The University of Wisconsin began its existence with two dormitories, North Hall and South Hall. Pressure of events deprived it of these residence halls, but the intention to restore this element of college life has persisted. In 1908 an appropriation became available but the act was repealed, and it does not seem likely that funds for the purpose will be obtained in the near future for the purpose.

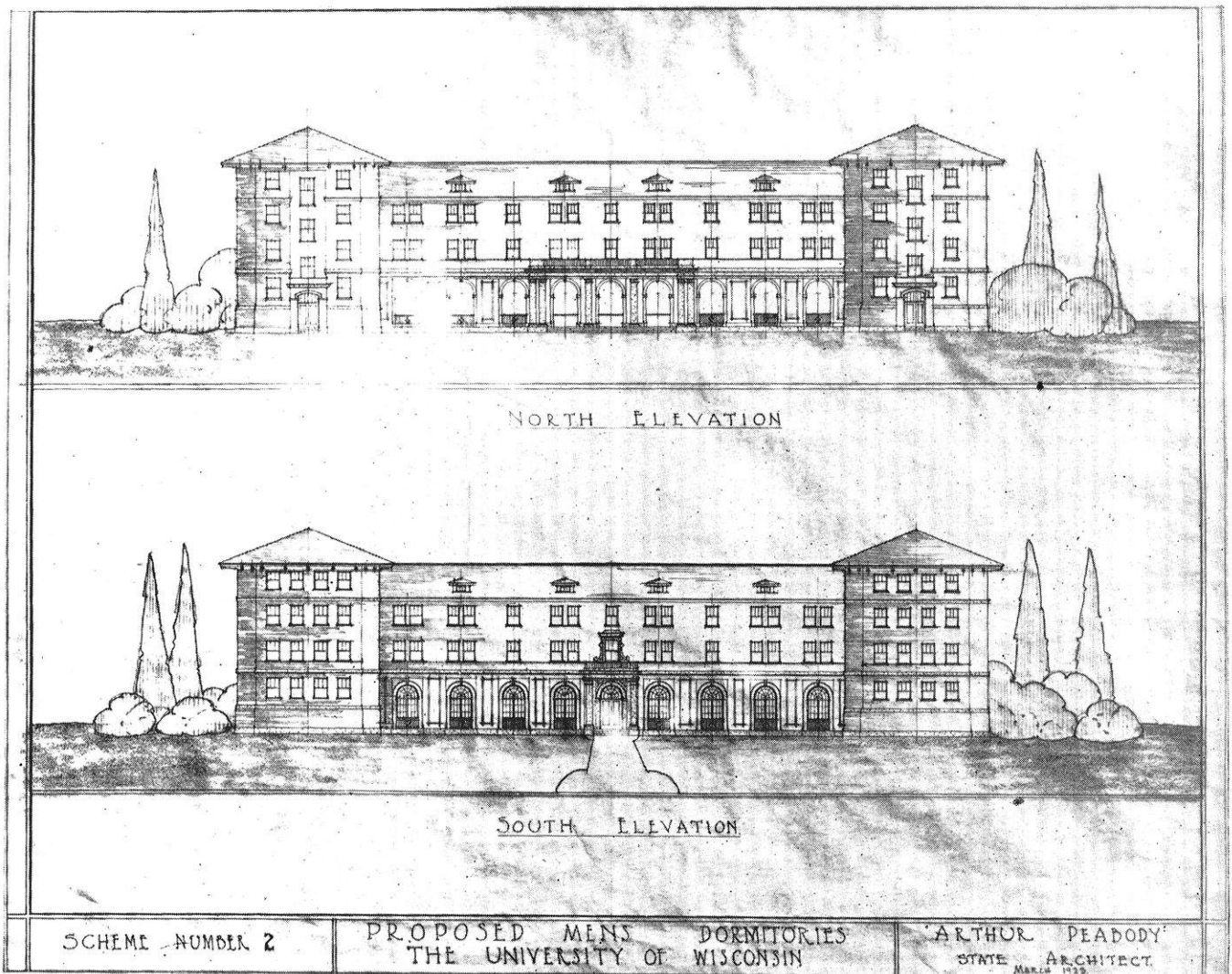
Authority to attempt a different method of financing has been obtained however, and there are those who look for the construction of dormitory quadrangles in the near future.

In a problem of this character the general study of dormitory projects is imperative and is being carried on by the Regents and their appointed committees from all points of view.

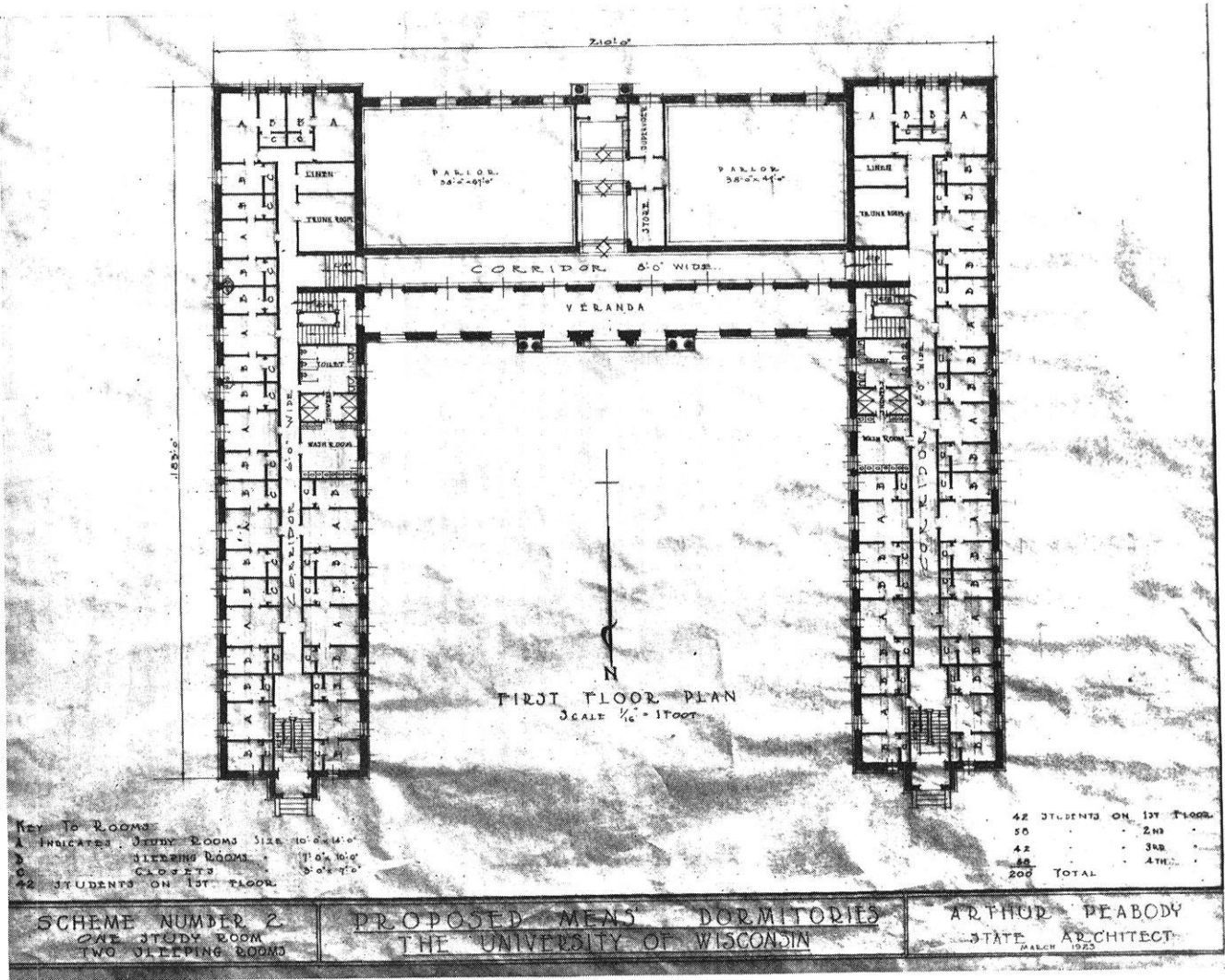
The plat of the grounds illustrating this project shows the entire number of buildings. These are each of considerable size, with a capacity between two hundred-fifty and three hundred men. Each building has a lake frontage and view, one of the most beautiful on the grounds of the University.

The completed group will be a notable addition to the campus; and one, which from all considerations, will answer most admirably the need for dormitories at the University.

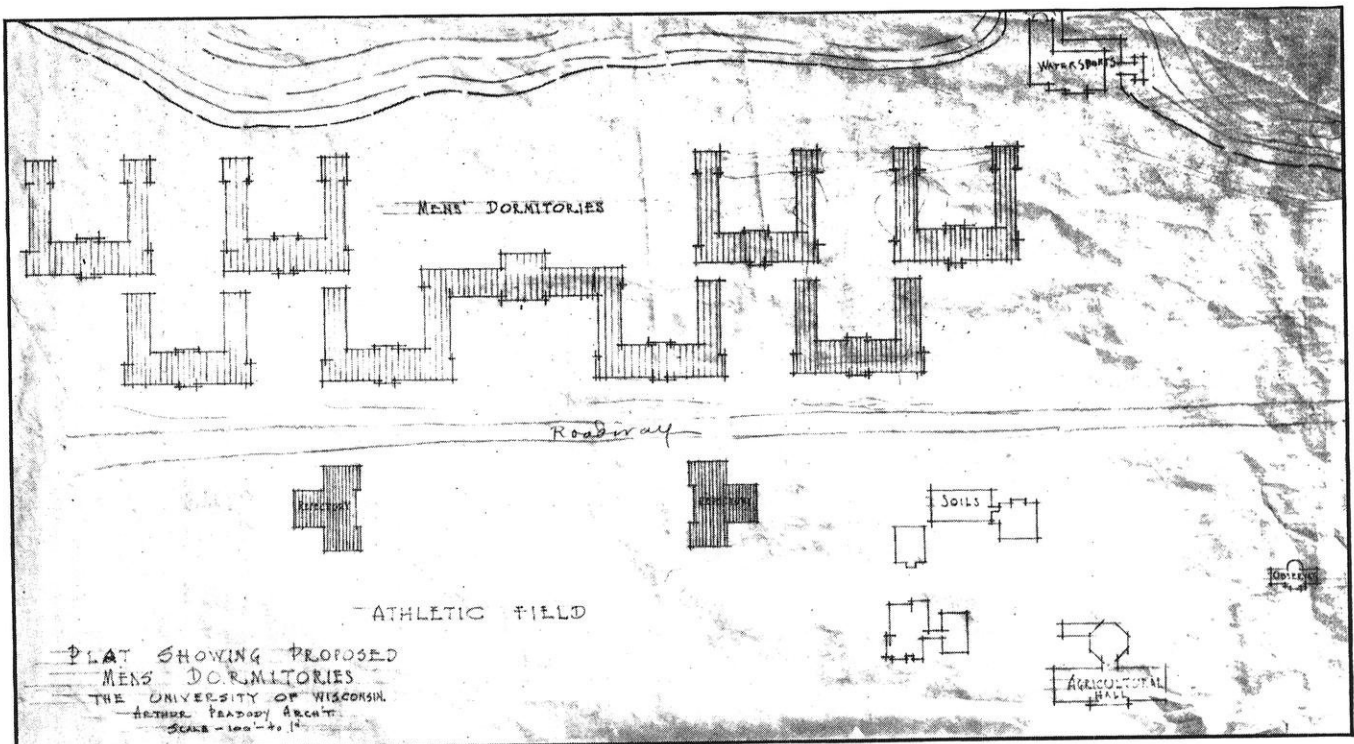
The construction program contemplates beginning at the east end of the group, and extending westward as conditions permit. A location on the shore of Lake Mendota about eight-hundred feet west of Bascom Hall gives room for dormitories of a capacity of about two thousand men. The construction of that number of dormitory rooms involves no small amount of money, and like all great projects there will be required adequate time for its completion.



EXTERIOR VIEWS OF PROPOSED DORMITORIES



FIRST FLOOR PLAN



SKETCH SHOWING THE PROPOSED LOCATION OF DORMITORIES WITH RESPECT TO OTHER CAMPUS BUILDINGS

Buildings of simple construction, but not unworthy for the purpose, are contemplated. Two principal types of dormitories prevail. One of these is based primarily on the plan of a corridor, like one of our great hotels, with rooms on each side. Another contemplates dividing the great building into sections, with not more than eight men on a floor, or about thirty men to a section.

The second arrangement, known as the entry plan has much to recommend it. Incidentally, it is somewhat more expensive per man than the corridor plan. At the present time, and for reasons of low cost, the corridor building appears to be most practicable. It would be fortunate if the other elements, such as occupation and enjoyment of life were equally promising.

The main difference in cost, however, concerns only fire walls between sections, separate stairways for each, and a redistribution of toilet and bathing facilities with some addition to the last.

An important item in dormitory building is the determination of the type of dormitory units. Three common arrangements prevail: one, the single room for one man; two, a somewhat larger room for two men; and three, a system of three rooms for two men, the central room being a study common to both. Of these, number two houses the greatest number per square foot of floor space. It is, however, the least desirable. Information from Columbia University, Pennsylvania, Northwestern, Yale, and Princeton confirm this opinion.

From the same sources one learns that number three is accounted ideal; although in certain colleges, Pennsylvania for example, student applications for number one, the single room, amount to seventy per cent; for number two, double rooms, eleven per cent; and for number three only seven per cent.

Economic pressure may influence this, as it does the plans for new buildings at Princeton, where the combination suite of two rooms and one study, reported as standard in 1914, has given way to single rooms. The building area, per man, is of course greater for the combination suite than for the single room, and still greater than for the double room type.

In any plan a certain space is necessary for the social side of dormitory life. In the corridor plan this develops into large common social rooms open to all. In the entry type a small common room is needed for the groups of thirty men.

With the dormitory project comes the question of the commissary. Three meals a day, and these not too remote from sleeping quarters must be provided. In many instances this requirement is carried by the refectory or student dining hall.

With women's dormitories, the dining hall is commonly integral with the building. For men, the ideal plan is the separate refectory for a considerable number of buildings, but not one capable of "feeding the crowd". With provisioning, as with lodging, mass treatment is not wholly desirable.

ENGINEER OR TECHNICIAN?

By JOHN SLEZAK, M'23

Engineer, Western Electric Company

WITH the application of scientific methods of analysis to practically all phases of human endeavor, the functions of an engineer are becoming more that of a leader rather than that of a technician, and it is gratifying to see that he is gradually assuming more responsibility for the universal well being. It is true that some engineers aspire to lead and others are entirely satisfied to be led. Of course, the latter are performing invaluable service to mankind both in scientific research and also in the solution of current engineering problems and if properly directed they may even attain prominence in their profession. However, the former are the pioneers in making the forces of nature subservient to the uses of mankind and they are the leaders in the establishments of a more sound economic order and in raising our standards of life.



JOHN SLEZAK

The leadership in modern industry depends more and more upon education and specialized training and the habit of analytical thinking, which the technical training tends to develop, destines the engineer of today to lead in service to his community. For who should have a better foundation to grasp large problems of economic organization and co-ordinate them more efficiently than a man possessed of thorough technical knowledge of his field and also fully acquainted with

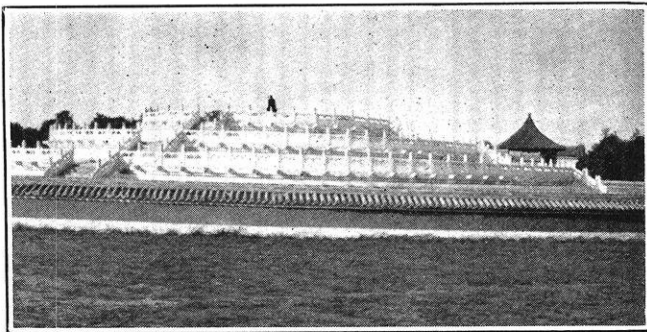
(Concluded on page 44)

SOME OBSERVATIONS OF CHINA BY AN ENGINEER

By W. J. FULLER

*Associate Professor of Civil Engineering, Milwaukee
Branch, University Extension Division*

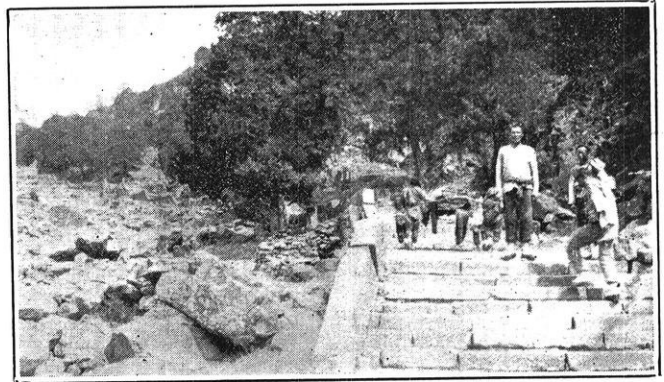
CHINA is a large country. The present area, including Manchuria, Mongolia, Eastern Turkestan, and Tibet is over 4,000,000 square miles with a population of about 400,000,000. The mineral resources of the country have hardly been scratched. People who have been there for the last 15 or 20 years say that they can notice improvements in conditions during that time, which although not great, nevertheless are improvements. This change for the better is bound to continue. There are thousands of missionaries in all parts of the country who are doing a vast amount of good. Chinese students are coming to the United States and to other countries, and they are carrying back with them new ideas. It will take time—probably a long, long time,—before the Chinese as a nation will advance a great deal. That is as it should be. In my opinion it is best for the Chinese nation and for the world at large that the change be gradual. When this change has come about, China, with all her natural resources and man power, will be one of the most powerful nations of the earth.



ALTAR OF HEAVEN

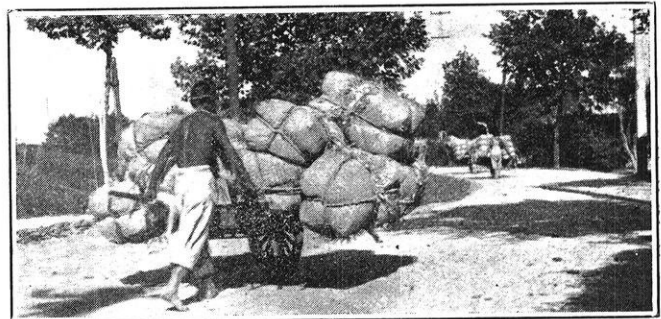
The Altar of Heaven is the most beautiful structure I saw during my two years in China. It is located in the southern part of the Chinese City about three miles south of the Tartar Wall around Peking. It was on this altar that the emperor offered up sacrifices once a year, at the time of the Chinese New Year. This structure is of white marble, much of which is beautifully carved. There are four entrances which are set square with the points of the compass. The altar is built in three terraces. The first is 210 feet in diameter, the second 150, and the third 90. The total number of balustrades is 360 (the number of degrees in a circle). The upper terrace is reached by three flights of nine steps each—(nine degrees of official rank; nine degrees of family relationship. The third flight of the Chinese Heaven, is also divided into nine sections). The top platform is arranged about a center slab. Here again

the nine occurs, as there are nine circular rows, with nine slabs in each row, the size of the slabs increasing with the distance of the row from the center. So it is with every part of the structure, which indicates that the magicians probably outlined the design.



ROAD UP TAI SHAN MOUNTAIN

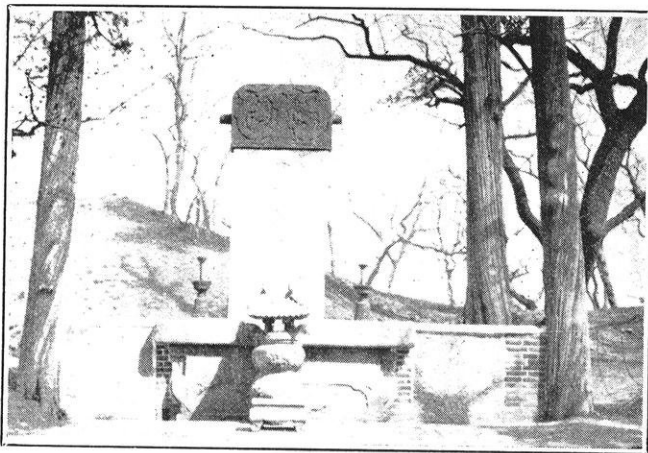
Tai Shan, probably the oldest sacred mountain in the world, is located at Taianfu. It is claimed that Emperor Shun offered up sacrifices on this mountain 2300 years before the birth of Christ. The mountain road is fifteen miles long and is paved all the way. Where the ascent is at all steep, steps have been constructed out of slabs of stone. There are 6300 of these stone steps. The road in places is from twelve to fifteen feet wide and is in very good condition, a fact which speaks well for the ability of the early Chinese engineer. On this road, like that of nearly all the old structures, practically no upkeep work of any kind is done. In fact many of the old structures will become nothing more than mixed piles of brick, stone, and earth unless steps are taken soon to make the long needed repairs. Many old temples are found on this mountain, and during the pilgrimages are so crowded that it is almost impossible to enter one of them. Numerous old trees, which because of the sacredness of the



WHEEL BARROW COOLIES

mountain have not been disturbed, add greatly to the pleasure of a trip to the top.

From February to May pilgrims make their visit to this mountain, and as many as 10,000 go to the top in a day. Some ride in chairs, some walk, and a few make the ascent on their knees. The chair ride was the most thrilling experience I had in China, at least when going down, as the steps were rather steep. Four coolies working in pairs were required for the trip. The design of the chairs is peculiar to this locality. They were uncomfortable even though I had cushions which were kindly loaned to me at the Methodist Mission from which point the start was made. The chairs were probably designed to be uncomfortable with the hope that the rider would soon become tired and walk,—thus relieving the carriers. It required six hours to make the ascent and only three for the return trip. In some places there were several flights of from fifteen to twenty steps connected by small landing platforms. The carriers went down three or four of these flights rapidly; then, when they reached one of the landing platforms, they suddenly swung around in a complete circle changing the load from one shoulder to the other and went right on down the next flight without slowing up. Just imagine yourself sitting on one of these flimsy chairs, the seat at about the elevation of the carrier's shoulder; you are probably a little dizzy not only from looking down 60 or 70 feet of stairway but also from being carried down so swiftly and then being suddenly turned completely around and carried on down, all the time wondering whether one of the carriers will step on a loose step or small stone. There have been accidents caused by one of the carriers slipping or stumbling. Probably the reason there are not more is because of an old local law. This law inflicts



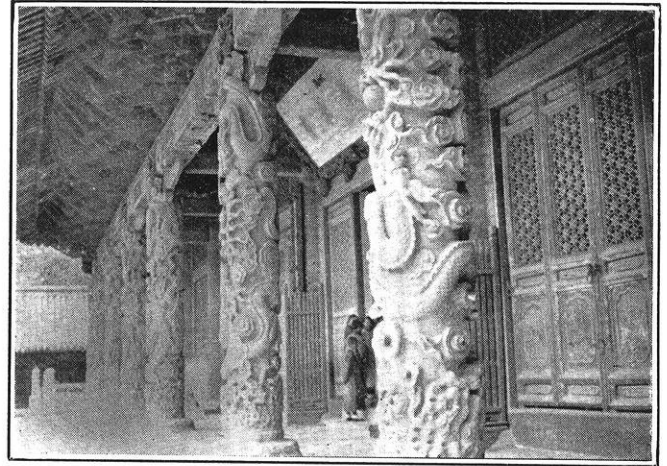
CONFUCIUS' GRAVE

severe penalties on any coolie who has an accident while making a trip. This road is a great place for beggars. Each has his own district of about fifty feet margin marked off by a row of small stones across the road.

The fact that Confucius visited Tai Shan on numerous occasions is no doubt one of the reasons why it is held in such reverence by the Chinese. From the

top one can look down onto what may be called the Holy Land of China where Confucius and Mencius, the great Chinese sages, lived, taught, and worked on their manuscripts.

Fifty miles south of Taianfu is Chufou where Confucius is buried. The burial ground covering 600 acres is about a mile from Chufou and contains the bones of



CARVED MARBLE COLUMNS
Confucian Temple

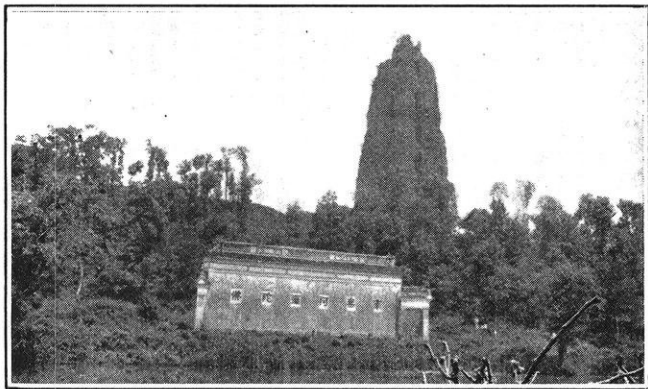
the Confucian Clan for the last 2500 years. A Confucian Temple, the finest in China, is to be seen here in this city. In fact about one-third of the area of Chufou is given over to the temple, its grounds, and other buildings. These buildings are on what might be called sacred ground, as Confucius spent many years on these same grounds teaching the people. One structure, built on the order of a grand-stand, is said to cover the spot where Confucius stood many times as he talked to the throngs of people who came from far and wide to hear him. The buildings house many almost priceless relics of bygone ages. The carved white marble columns or pillars on two of the buildings are truly a work of art and alone are worth the time necessary to visit the grounds. They have been called "One of the marvels of Chinese sculpture."

Both in the burial grounds and on either side of the road between the burial ground and Chufou are wonderful old cedar trees; some of them are over three feet in diameter. It is only in places of this kind that old trees are found. Of course here and there a few trees mark a grave, but they are comparatively young. In fact it has been said that a grave is the only excuse for a tree in China. I am glad to say that at present the Chinese Government is conducting a great deal of experimental work in forestry. Let us hope that some day China will not be so barren of trees as it now is.

The pagoda, although often built in connection with a temple, is not, as usually thought, a place of worship; however, the pagodas sometimes contain images which are worshipped by pilgrims. The pagoda is usually built more as an omen of good luck for the community

or by some person who has the funds and wants to show either his gratitude for some great good fortune that has come his way or wishes to make up for some great sin he has committed. In Soochow the Two Pen Pagodas, sometimes called the Twin Pagodas, were built near the Examination Halls by a scholar in order to attract the luck required to insure good scholarship. The scholars, however, did not pass the examinations and something was thought to be wrong so the magicians were consulted. It was finally decided that the trouble was due to the fact that the city possessed Pen Pagodas but no Ink Pagoda. An Ink Pagoda was built, and the Soochow scholars were successful in the examinations each year.

The Thunder Peak or White Snake Pagoda near Hangchow holds an important place in the history of the city. It is said a large volume has been required to cover the stories of its origin. This pagoda was built about a thousand years ago. Hangchow dates back to 2198 B. C. and probably has the most beautiful surroundings of any city in China. It is here that the finest fan and drug shops in the country are to be

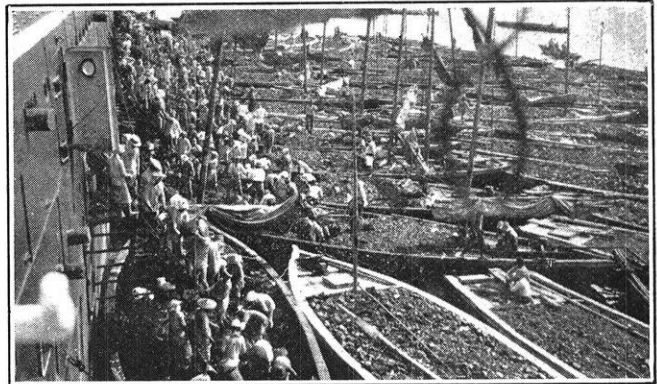


THUNDER PEAK PAGODA
Hangchow

found. Thunder Peak Pagoda is the only ancient structure in China which contains red bricks, and it was built before red bricks were made in China. The explanation is given as follows: About 370 years ago the Japanese pirates infested the region about Hangchow. Whenever they made one of their raids, it seems that the Chinese were always prepared for them. It was finally decided that the Chinese watched for them from the top of the pagoda, and they resolved to destroy it. They spent some days gathering wood which they piled around the pagoda and set on fire. The fire burned for three days and three nights but did not destroy the pagoda. It did, however, burn off all the woodwork and change most of the bricks near the surface from blue to red. Note in the picture the trees growing on the pagoda; a number of these trees are from 20 to 30 feet high.

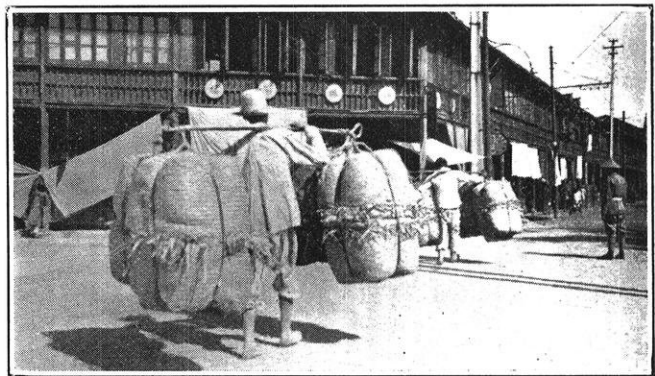
The coaling of a large boat at Nagasaki is one example of the great amount of work performed by the coolie class in the Orient. The picture shows the coaling of the Empress of Russia "by hand". The

boat hardly comes to a stop before barges of coal crowd around from every direction, and coolies, all covered with coal dust, appear on deck to make fast the ropes which support the steps. Each step is supported by a different rope. The steps are built up out of boards



COALING "EMPRESS OF RUSSIA" BY HAND
Nagasaki

and are so arranged that as the boat settles, on account of weight of the coal taken on, the lower steps may be removed. The number of steps depends upon the height of the coal hole in the side of the boat. The top step is really a small platform which rests against the side of the boat, while the other steps are supported laterally by short bamboo poles which rest against the side of the boat. As soon as the steps are completed, coolies take their places, sometimes one and sometimes two on each step. The coal is shoveled into small dust pan shaped mat baskets holding, I should judge, from 15 to 20 pounds. These baskets are passed up from one to another until it reaches the top coolie who dumps the coal into the coal hole and tosses the basket down onto the barge. I timed several groups and the best I obtained was sixty baskets in one minute — for one



COOLIE WITH BAMBOO CARRYING POLE

minute only. The average was about forty-five per minute. A large percentage of the workers were women, and as far as I could see they worked just as hard as the men. They all seemed to be very cheerful; if one of them missed a basket and the coal fell on those below, they all joined in and had a good laugh

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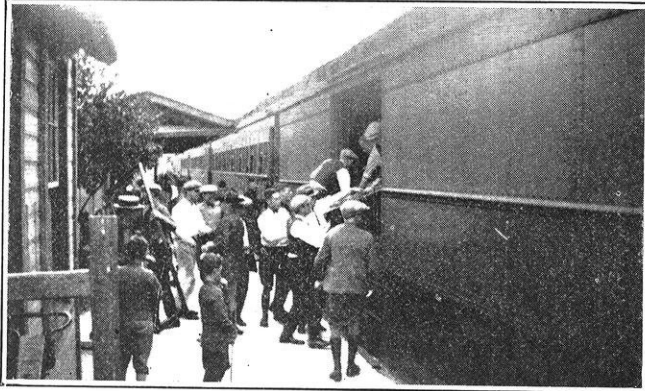
A REVIEW OF THE 1924 SURVEY CAMP

By LOUIS C. ALK

Senior Civil

"WHOSE baggage is left on the platform? Come on! We're ready to go. No one's? All right. All aboard!" The brakeman sounded his last warning, and the train loaded with rough looking, oddly dressed engineers — in the quest of knowledge and healthy tan — moved out of the Madison Station.

"Stop the train! I forgot my baggage!" But "Late" Harms was too late. There was no doubt of it. The



UNLOADING EQUIPMENT

Tripod Legs shot into the air with the speed of lightning, and sometimes crashed with the sound of thunder

Wisconsin Civils were on their way. Once again Devil's Lake would be "accurately" surveyed, and contours repainted and retwisted on the ground; once again contour 970 would make capers in its snaky journey.

All established records were broken in unloading the equipment. Tripod legs shot into the air with the speed of lightning, — and sometimes crashed with the sound of thunder. Thwait's almost lost his magnificent moustache in the intense wind caused by the flying instruments.. Martin's wagons were soon loaded to

capacity, and the first sweat of the camp had been exuded. After a short journey on a hard, rocky road and with many misgivings among the tenderfoots as to the number of contours piled up on the bluffs, camp was reached, the tents quickly erected, and several parties sent out on surveys, — all on the first day. The routine work had begun.

Rain, rain, rain! The daily routine had indeed begun; for it seemed to rain every day, — especially when anyone was assigned to a topog area. Despite the unfavorable weather, the field work was continued because no office work could — as yet — be done. Mr. Stivers led the railroad men a merry chase through the mud, the best swimmers taking the job of chainmen. If the weeping weather continued, the problem promised to become one in river navigation rather than rail transportation. Everyone thought it futile to try to locate a railroad at that time; the rain was sure to wash away South Bluff. The road to Bularena could be easily established then. Naturally, the railroad department rushed its work, because the task would be too greatly simplified if South Bluff were removed. A final report would then read: "The best available route is a straight line from the depot at Devil's Lake to the Bularena Mine."

Rain, rain, rain! The road in front of the tents had long since become impassable. Tourists mired their cars in an attempt to get through. At such times the camp would turn out, a rope would appear as if by magic, and out would come the car. What could resist these engineers? Nothing, not even George Reed's tempermental Ford. When "Lizzie" refused to go through the muddy roads, the engineers proved that a Ford can be coaxed where it cannot be driven by pulling the car to camp. In spite of the weather,

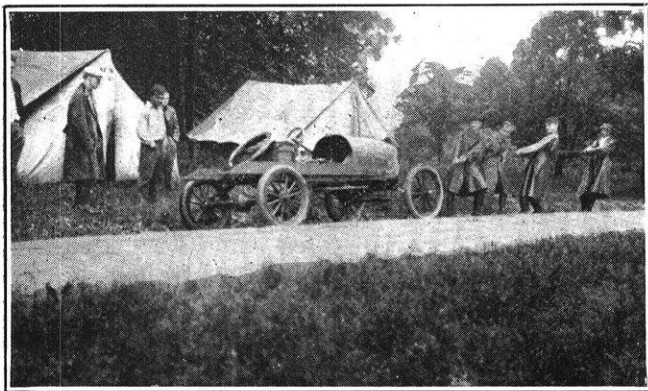


THE CIVIL ENGINEERS' 1924 SUMMER SURVEY CAMP

the engineers were optimistic. Day by day, hopefully, they sang, "It ain't gonna rain no more." But that Coué stuff didn't work.

On June 28th a general celebration was held. The sun came out! It was then that Engelke uttered the famous words, "We've been in camp thirteen days and it's rained fifteen." The thanksgiving was of no avail, for two days later the sky poured forth large hail stones. Beautiful weather for the last of June! Nights were cold, and heavy blankets were at a premium. Pity those who had taken too few! At last Prof. Owen might say "I told you so."

The two-weeks men had been hammering away daily on their railroad while the six-weeks men "rested up" half of the week with T. E. work. The thrill of the reconnaissance! Romantic railway engineers! Like blood-hounds on the trail, each followed his grade contour up, always up, and sideways, always in the general direction of the Bularena Mine. Eventually the road was surveyed and the log cabin located.



PULLING GEORGE REED'S TEMPERMENTAL "LIZZIE"
TO CAMP

*The Engineers Proved that a Ford Can be Coaxed
when it Cannot be Driven*

Realizing that they were soon to leave camp, the railroad men "railroaded" the Engineer's Prom into the end of the first two weeks of camp. With George Abendroth as prom chairman and with Molzahn — Shiek of Baraboo — as official girl-getter things began to happen. "Lot of them in Baraboo, fellows!" The engineers "stepped it off" in the mess hall which had been transformed into the State Capitol by the Owen girls. Prof. and Mrs. R. S. Owen and Prof. and Mrs. L. F. Van Hagan acted as chaperones. "A good time was had by all", although it rained.

Radio reports from the long-winded democratic convention provided excitement for nine days or so, but the real recreation was baseball

"Be-ase-ball!" Rundel always issued the call; but Mr. Stivers was the living spirit of the game. He covered third base like a tent. The camp discovered or developed Ty Cobbs and Caseys galore. Coates, when fully aroused, made Babe Ruth look like a back number. Pitching honors were usually divided between Harms, Rundell, and Mohlzahn. The crucial game of

the season was between the Rinky Dinks and the Gas House Goofers. The umpire won.

Don't rear your boy to be an umpire. It's worse than being a road inspector. There will always be some who make the life of an arbitrator a hard one. Even Rundel, befriender of snakes and umpires, would pull the high ones over the plate in an attempt to pull one over on the ump. If he succeeded, the popular cry became, "Shine your glasses ump" or "Get another pair." Stivers claims that the runner should be allowed to carry second base with him. According to popular opinion when "Shorty" Stivers was at bat, a "strike" meant a "poor" for the ump, while a "ball" or "safe at first" earned an "Ex." One of the best rules for an umpire to follow is the law of averages. You have to hit it right sometimes that way.

The summer was passing quickly; but, as yet only Mr. Wesle had been fortunate enough to kill a rattlesnake. Better times were bound to come; and they did. Bartleson and Smallshaw electrified everyone by bringing in a real live rattler with eight rattles and a button. It was supper time. All were peacefully stowing away the grub when the snake charmers, their faces flushed by triumph and victory, appeared on the scene tenderly carrying their captive in a canvas cloth. With one accord most everyone rushed out to see the first live rattler — to watch it strike and hear it buzz. Some few stayed behind at the tables to do away with more dessert than they had coming. The rattlesnake was quickly caged and placed near the fountain to be viewed in awe by passers-by. It was a real live rattlesnake.

Now that the camp owned one pet and curiosity, the engineers, not at all satisfied, looked around for more. It was at first suggested that Thwait's, with his wonderful moustache and full-grown beard, was a big enough curiosity to be caged as a playmate for the rattlesnake. As time went on, however, others succeeded, with the aid of lye and other fertilizers, in growing shadows under their noses. However, Thwait's moustache reigned supreme throughout the camp.

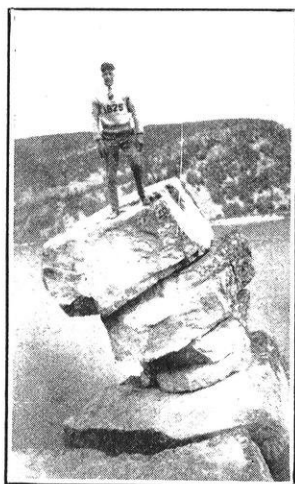
Several coons were caught, but they were soon given their freedom.

Later more snakes began to come in Jensen killed several. Mr. Blake got a live one, which he playfully sent to a friend in Superior — as a joke. Not all the pets in camp were caged, however. Who could catch and cage the various bugs, spiders, and field mice which kept us company. The field mice really enjoyed camp life. They had loads of fun playing tag on the tent tops at night. Mickle wanted to charge them rent; one morning he found a nestful in one of his boots!

Many of the fellows were beginning to look like specimen "See the Wild Man of Borneo." Saturday evening pilgrimages to Baraboo were consequently inaugurated. The barber shop was the Mecca for many. Harms asked for a haircut and got a shingle bob. Occasionally — it surely was not often — Baraboo was visited for more romantic reasons. It was not long before Mohlzahn had earned the name of

Shiek of Baraboo. The North End proved more popular than Baraboo. There the fellows danced the light fantastic to the tune of an electric piano. Trips to the North End were infrequent, however. The walk was long, the boat ride worse, and the time off from computation little.

Odd as it may seem, some of the fellows found pleasure in using their spare time to explore the shores of Devil's Lake. The scenery is beautiful and worthy of a little additional climbing. It would indeed be unfortunate if future surveying camps could not be



RUNDELL ON
TURK'S HEAD

His teeth almost shook out, and his knees bumped noisily together in the act

held in Devil's Lake. To climb and stand on Turk's head was the objective of many. Many climbed it, but few dared to stand on the rock — five hundred feet above the water. Rundle did it but his teeth almost shook out and his knees bumped noisily together in the act. Plautz almost had heart failure as he watched him do it.

July Fourth was a "big" holiday in camp. A level running contest had been planned for the day, but it fizzled for lack of contestants. Everyone seemed intent upon catching up on computation. Some of the natives had been expecting a good-sized celebration by the engineers. In fact one of them asked when

we were going to shoot off those large rockets that had been placed all around the lake. Reed told them that the rockets would be fired later in the evening. Could he tell them that the "rockets" were just plain triangulation stations? "Why didn't you say they were Christmas candy?", Amundsen queried of Reed.

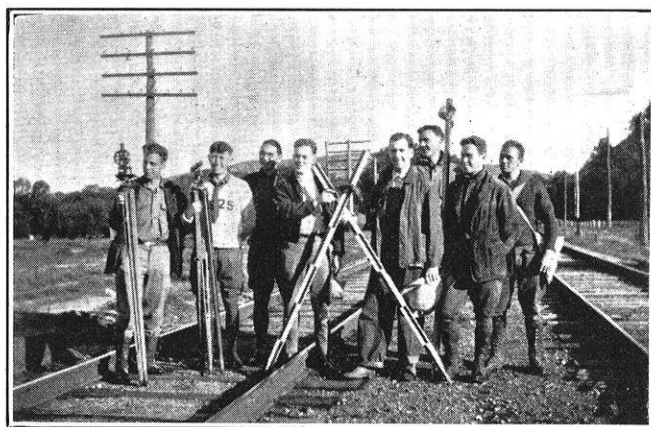
The engineers made their first speaking acquaintance with dams in Water Survey under the direction of Mr. Beebe. Rapid survey it was called, and rapid survey it was; excellent training for the Varsity Cross-Country track team. A mystery was offered for solution on this trip when a burlap bag was seen falling — or rather thrown — over a bridge onto one of the dams in Baraboo. What could be in it? Speculation ran high. Nothing ventured nothing done, so Jensen, Sales, and Rundel waded into the water and rescued the bag. Alas for mysteries. The bag contained several dead chickens; for this,— wet feet and wet white navy trousers. Mr. Beebe had charge of all the courses offered in Baraboo. It gave him splendid opportunities to test out the qualities in the new paint applied by himself on his car.

Collins, speed artist, not satisfied in having us chase contours on dry land, made us dive under Devil's

Lake for them. Bottomography of Devil's Lake was terminology that inventive genius gave to it. All parties except that in which Jensen reigned supreme used the regular method of flag and time signals to keep tab on the soundings. Jensen made this quite unnecessary in his party; he could command his voice so well that he could be heard all over the lake. He shouted his directions from the top of west bluff. "Ya want any ice today, lady?" he would ask in well modulated tones. "No, your ice melts," the answer would float slowly back from the lake.

From July second the call had been issued for shooting Polaris. Daily Prof. Owen would announce hopefully, "Weather permitting, we'll time the stars." It was not, however, until near the close of camp that the heavens were sufficiently clear for us to check up vanced age — and the rainy weather — an observatory was built over Polaris Station.

Day by day, the office work was piling up higher and higher. How to finish all the work became the main topic of the day. The commissary had a flourishing business in candles; for after ten o'clock Kohler's Electric Lighting Plant ceased to function for our benefit. Oh, Abe Lincoln! You had nothing on us when it came to plenty of work by candle light.



A RAILWAY PARTY

Romantic railway engineers! Like bloodhounds on the trail, each followed his grade contour

Every night became a twelve-thirty night; the assignment for Sundays was computation. Prof. Kinne, on a visit to camp, was shocked to find even Coates hard at work. Little recreation was offered or taken in the last two weeks at camp. Baseball was played but infrequently. Every evening Vern Kneer would walk out of his tent look at the sky, stretch his arms lazily, and say, "Well, boys, I've had my evening's recreation. Now I can get back to work." Even swimming was neglected. The Owen girls and Flueck, camp fish, were the only ones to enjoy the sport regularly.

Eats were good and plentiful at the camp. It was a big task to keep a gang of hustling engineers well fed and satisfied, but that job was successfully managed by Mrs. Owen. That the food was good and wholesome

(Concluded on page 44)

THE SUMMER COURSE IN CHEMICAL MANUFACTURE

By W. RALPH GILES

Senior Chemical

THE sixteenth of June was a busy day in the Chemical Engineering Building, for on that day twenty-five junior and senior chemical engineers began work to solve some of the problems of the chemical industry, and incidentally to gain a great deal of practical knowledge of the deep and profound mysteries which will confront them in the years which lie beyond.

Great surprise and curiosity were exhibited by all over the outcome of the partnership that was formed by Haase and Hall, who were assigned the problem of softening Madison city water with Zeolites. "Haas" thought that the water was already soft, because he could put his hand into it, but after many heated arguments with Hall, he was finally convinced that it must be hard. So they set up a laboratory in one corner of the building, and softened water for five weeks. It is a mystery how they kept at it for the whole time, but at any rate they seemed to give satisfactory evidence that they were working.

Probably the most useful problem, which was only partially solved, was the absorption of ammonia by water. Perry Fulkerson, Walt Plewke, and Les Diskson worked most diligently under the supervision of Prof. Hougen. It was very queer, however, that they always had a great deal of computing to do in the front yard just at the time when the girls walked in to classes in the auditorium. Perry was the greatest offender at this, altho we never did see any results of his efforts.

Harry Kuhe and George Ballam worked a long time trying to extract benzol from gas main oil, but the queer part about it was that instead of finding benzol, they obtained enough naphthalene to put all the clothes in Madison in moth balls for several years.

The extraction of the useful products from pyrolygious acid was a problem over which many of the boys perspired. One of the main constituents was alleged to be wood alcohol, but all that could be obtained was a darn good smell. After much argument and many distillations, it was finally decided by Koresh, Schmidt, Wheeler, and Giles, that the wood alcohol had already been extracted.

George Brabender and Frank Maresh worked for three weeks analyzing city water and softening it. They finally decided to give it up as a bad job and start the distillation of "drip oil." It was from the results of this job and also from the purification of acetone that they secured the reputation of making the vilest smelling odors. They should have been assigned the problem of making soap so that they could have been induced to wash more frequently. It was usually the case that the dirtiest people were given the problem of making soap. Ridgway and Davidson accumulated so much dirt that they could not even make good soap the first time, but had to spend the last few days in

frenzied hurry in an effort to make some "99.44% pure". "Frank" always seemed doubly interested in the manufacture of soap. Whether he needed it or not, he was judged the best all around "good scout" in the school. Many were the problems which would have been entire failures had it not been for his help and practical knowledge.

Froehlig and Eyer worked the entire session on the extraction of linseed oil from the flax seed with various solvents. The consensus of opinion was that they worked pretty hard. At least they had a wonderful apparatus in one corner of the basement, which looked like a "hum-dinger" when it was first set up. The unusual feature of it was that the cooling water in the condenser came out where the product should, and after a detailed investigation it was discovered that the condensing coil was missing.



SENIOR CHEMICALS

Everyone in pursuit of knowledge

Peterson and Sindt took a good course in pipe fitting when they set up their apparatus for the distillation and recovery of waste crank-case oil. They both agree that they are well qualified to be called plumbers. "Bud" Taylor thinks he, also, is qualified, if pipe fitting is all the requirements for a plumber. From his description of his problems, one would judge that he had to pipe the whole building each time before he could start.

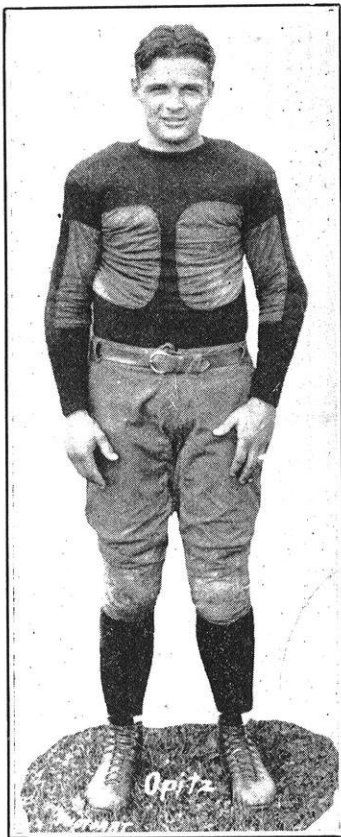
"Milt" Ehlers and George Lonergan worked for three weeks to prove a theory of filtration.

Other problems upon which much time and effort were spent included the manufacture of lithopone, water glass, acetone, purification of alcohol, and the extraction of potassium chloride from kelp.

The hardest, but most enjoyable problem was given out to all of us on the last day. It was to consume three gallons of frozen ice cream. The analysis, as determined by "Haas", showed it to be of extreme purity; so it was all disposed of according to the capacity of the various parties present.

EDITORIALS

HERBERT CHARLES OPITZ In a community of seven thousand it is inevitable that tragedy will at times appear. Tragedy has appeared; a brother engineer, Herbert Opitz, senior mechanical, was accidentally electrocuted on October 23 while completing an experiment in the electrical laboratory.



HERB OPITZ

In his death the military department has lost a lieutenant-colonel, the football squad a capable quarterback, the school of engineering a very good student and promising engineer.

His fraternity brothers in Theta Xi showed their friendship and regard by attending the funeral en-masse — the entire chapter going to Elkhorn for the rites. The athletic department has awarded him an honorary "W".

The accident which caused his death was entirely avoidable, but is none the less a sad one. We lament his loss as a brother engineer, and as a man.

Every adversity is a blessing in disguise. Our failures of to-day become the foundation stone of success tomorrow if we properly interpret them. — Napoleon Hill.

OUR ENGINEERING LECTURES

Soon, as we dash madly to our eight o'clocks, we will find an announcement similar to this placarded in the corridors of the Engineering building:

"C. E. Gazookus will speak on the Mazuma dam (or power line) at 10:00 A. M. Tuesday. All classes in professional subjects will be excused."

And to entirely too many, we are afraid, the signs will only mean an unexpected but welcome respite from a certain class or other. The College of Engineering goes to an appreciable amount of trouble and expense to bring these men here, all big men in their line, only to have them blissfully ignored by the majority of the students. Attendance is voluntary and highly beneficial. We almost wish it were compulsory.

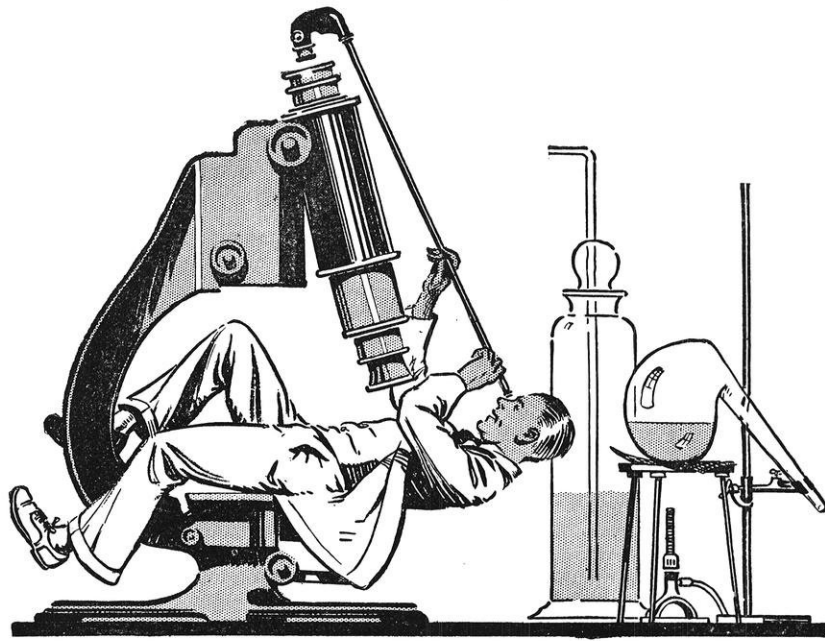
The Engineer takes this opportunity to recommend the lectures offered, which are of very high calibre and certainly worthy of attention. You surely cannot utilize more advantageously the hour given you by the faculty. All the studying or back work you may accomplish during that time cannot commence to recompense you if you miss one of these interesting talks, so let's start the new year right and take advantage of every lecture.

Seek happiness for its own sake, and you will not find it; seek for duty, and happiness will follow as the shadow comes with the sunshine. — Tryon Edwards.

IS ENGINEERING AN OVERCROWDED PROFESSION?

A statement is said to be circulating in campus circles to this general effect: There is no use to go in for engineering; the profession is overcrowded. It is worth a moment's time to consider this matter in the light of some rough calculations.

In the first place, industry in this country is expanding at the rate of about 4 per cent a year, and industry supplies the bulk of the work for engineers. Secondly, death takes its toll each year from the profession. The "expectancy" of life of the engineer at the time he is graduated from college is 41 years; so it is evident that 2.4 per cent of the members of the profession must be replaced each year because of death. Finally, desertion and advancement — that is, promotion from engineering to executive positions — make inroads into the membership. Desertion we will consider negligible. Upon the item of advancement there is at hand only one bit of information, namely, some figures from Lehigh University which indicate an annual loss through advancement of about 2 per cent. The total of these items is over 8 per cent.



Worth looking into

IT'S the most interesting study in the world.
What is? Why you, yourself.

Put yourself under the microscope. Examine yourself most searchingly to find out just what kind of work you have a natural aptitude for.

Don't leave your career to chance. Don't be satisfied with any nonchalant observation of what may seem to be your best field.

Upperclassmen who have applied this careful self-study will tell you it helped them pick out the "major" which fell in most closely with their natural fitness. The result—greater interest and greater profit through their whole college course.

Graduates will tell you that the man who turns the microscope on himself is happiest in his choice of a life-work.

It comes down to this—some patient analysis now may be the means of putting you on the right track for the rest of your life.

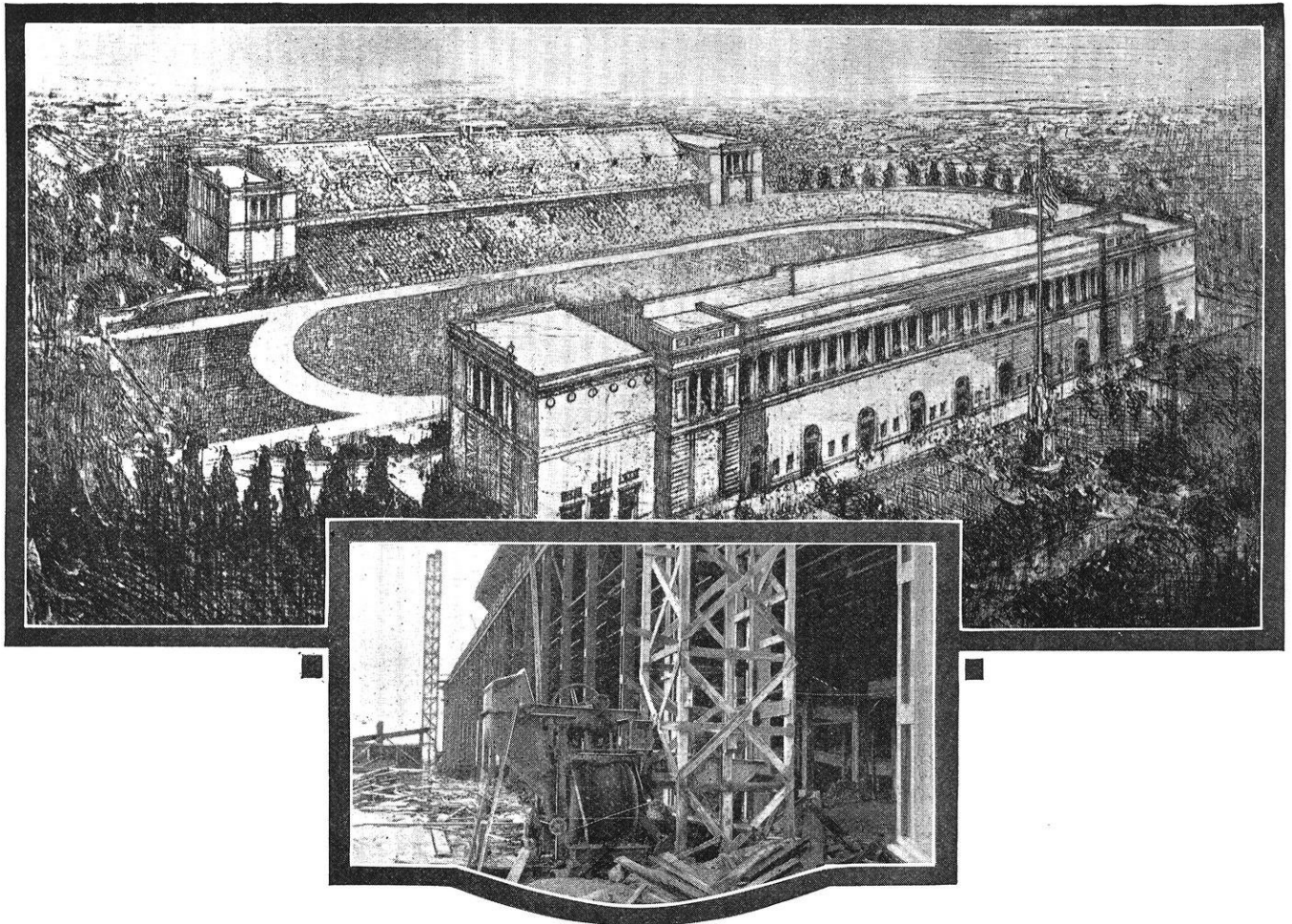
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the interest of Elec-
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an Institution that will
be helped by what-
ever helps the
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Number 42 of a series

Kindly mention The Wisconsin Engineer when you write.



Illinois Stadium and Koehring

ILLINOIS Memorial Stadium, one of the mightiest arenas built to accommodate the ever increasing throngs of football enthusiasts stands completed, an awe-inspiring, peerless monument to Illinois spirit. Covering eight acres, located on a 56 acre field, it has a present seating capacity of over 60,000, two-thirds of which are within the limits of the goal posts. The enclosure of both ends will bring the capacity to 120,000 seats—a truly gargantuan achievement. Each side is 546 feet long and the top is 112 feet above the playing field.

Twenty thousand cubic yards of concrete mixed in Koehring Construction Mixers became transformed into enduring stone foundations, ramps, bannisters, walls, and seats in this remarkable football stadium.

On notable construction work, in every section of the country, Koehring concrete mixers are found contributing their unmarked but highly important part.

“Concrete—Its Manufacture and Use”, now in its fourth edition, is a 207 page treatise on the uses of concrete, including 26 pages of tables of quantities of materials required in concrete paving work. To engineering students, faculty members and others interested we shall gladly send a copy on request.

KOEHRING  **COMPANY**
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Manufacturers of Pavers, Mixers—Gasoline Cranes, Draglines, Shovels
Kindly mention The Wisconsin Engineer when you write.

The census returns for 1920 indicate that there were then about 250,000 men engaged in professions taught in technical schools. The necessary number of technical recruits each year is, therefore, eight per cent of 250,000, or 20,000.

How does the output of the technical schools compare with the demand? It is estimated that there are 50,000 students in the schools at present. Based upon our experience here at Wisconsin, about one-fifth of this number is being graduated each year. That means 10,000 new engineers where 20,000 are needed. In other words, half of the engineering needs of the country must be met from other sources than the engineering schools. Evidently the demand is greater than the supply of technical graduates.

The verification of these estimates is found in the ease with which the graduates are absorbed into the ranks of the profession.

There is no class of men so difficult to be managed in a state as those whose intentions are honest, but whose consciences are bewitched. — Napoleon.

SUMMER EXPERIENCE

A strong desire to complete the college course as soon as possible often induces an engineering student to attend two or three summer sessions at the university. As a general rule, the student who attends the summer session does not often secure the proper kind of remunerative work for the remainder of the summer vacation period. Some students segregate themselves almost entirely from the practical business world during their four year period of college life.

Although a college education is supposed to prepare an engineer for his profession, there are other factors that often determine the degree of success that a man is to attain. Before he can be a man among men in the technical world, the engineer must have some knowledge of business organization and financial management.

Too many of our engineering graduates do not have a sufficient knowledge of the fundamental principles of financing or of business management as practiced in industry. In most cases, the blame for a lack of such knowledge can be placed directly upon the shoulders of the student. Every summer vacation offers an opportunity for the engineering student to acquaint himself with the business world. Practical experience is always an important consideration when the graduate goes out into the world to secure a permanent position. No college education can in itself completely prepare an engineer for his profession. The remainder of his preparation must come from a contact with the matter of fact industrial world in which he will later find himself.

"Neither is a dictionary a bad book to read — it is full of suggestions."

The study of literature nourishes youth, entertains old age, adorns prosperity, solaces adversity, is delightful in the home, and unobtrusive abroad. — Cicero.

PERSONAL CONTACT

One of our chief problems in life is getting along with other people. At every point as we go farther into the experiences of life the problem of living and getting along with others meets us. It is not always easy to gracefully accept these contacts and to enter into kindly and harmonious relations with them. We meet people of all types. There are some people who seem to be satisfied when alone, who think of no one but themselves, and who make living wretched when thrown in contact with others. Then again there are the selfish, despotic, wilful and exacting. They will not yield to another's necessity and persist in having their own way and attempt to ride through life rough shod over other peoples' comfort, feelings, and desires.

It costs something to live with people. The price is self-forgetfulness and the giving up of the idea that we are the whole show. We have to compromise and be willing to meet the other fellow halfway. We must give up many of our own preferences and desires so as not to conflict too strongly with others. Many a promising career has been ruined because of the failure to appreciate the fact that there are other people in the world who also desire some of the things we do. The question is how may one get along with other people? This matter is vital with engineers. In the first place keep in mind the great goal of all engineers: service. Whatever attitude one assumes toward others, it is reasonable to expect that others will assume the same attitude toward you. In this lies one of the secrets of success. In the second place thoroughness plays an important role. It is not necessary to go to any extreme, but a kind act here or a kind word there will go a long ways towards making things happier and more harmonious. A spoken word cannot be retrieved and the effect remains in spite of profuse apologies and regrets. It takes but little effort to exercise thoughtfulness and the results are often astounding. We can suggest other essentials such as good temper, respect of others, a general exercise of common sense, and a general love and understanding of mankind. In work of great responsibility these elements must be practiced. A rash word or a hot-headed rebuke may cause sulkiness of a dangerous sort. It should be the aim of all to be continually aware of his association with others and to practice self-restraint and self-forgetfulness.

A miser grows rich by seeming poor; an extravagant man grows poor by seeming rich. — Shenstone.

The secret of success in life is for a man to be ready for his opportunity when it comes. — Disraeli.



ENGINEERING REVIEW

H. C. WOLFE

MERCURY BOILERS

The value of mercury boilers, using mercury vapor in the place of steam, in plants is justifying all expectations, according to a statement by Dr. L. R. Emet, consulting engineer of the General Electric Company, addressing the World Power Conference in session at London. The efficiency of mercury vapor for developing power lies in its use of extremely high temperature without excessive pressure and its adaptability to turbine engines. Also the heat of condensation can be used for making steam for auxiliary power or for other purposes.

The continued operation of the mercury boiler and turbine at the Dutch Point Station of the Hartford Electric Light Company has suggested modifications and improvements without developing additional difficulties. Special boilers and fittings must be used suitable to the high temperatures. Leakage of mercury and mercury poisoning seem to be entirely avoidable. Repeated measurements of the fuel used and the energy delivered show a saving of 50 per cent in fuel together with other advantages of reduced space occupied and the amount of water required. Mercury power is well adapted to locomotives and boats. The studies indicate a saving of 60 per cent in fuel with improvements based upon the experience acquired at Hartford.

The supply of mercury for the increased demand which may follow a more general use of mercury for power purposes does not seem to be limited. Abundant sources of mercury are known and require only a slight rise in price to bring it on the market, and other sources of supply will doubtless be revealed.

Science

AMERICAN INSTITUTE TO HOLD EXPOSITION OF INVENTIONS

An Exposition of Inventions is to be held, December 8th to 13th inclusive, 1924, in the Engineering Societies Building, New York City. The American Institute of the City of New York is handling this display through its Inventors' Section, with behind it an experience of ninety-six years in fostering and portraying American industrial life.

A feature of the Exposition will be exhibits from the leading American industries showing developments of various machines, utilities and processing methods.

In all fields the ingenuity of the inventor and the part he has played in the progress of America will be emphasized.

In this display of American inventions the American Institute will be continuing with a new emphasis almost a century's encouragement of inventors and introduction of their works to the public. Among inventions now used throughout the world that were first displayed to the public at earlier All-American fairs of the Institute are the Morse telegraph, the Hoe lightening printing press, the McCormick reaper, the Howe sewing machine, the Bell telephone, the Colt revolver, the Francis metallic life boat, and many others.

ALASKAN PAPER INDUSTRY LINKED WITH WATER POWER DEVELOPMENT

It is only a question of time when the shortage of newsprint paper stock in the United States and Canada will compel the manufacturers to go to southeastern Alaska for their pulp timber, declares J. C. Dort, Hydroelectrical Engineer of the Forest Service, United States Department of Agriculture, in his recent report on water power in Alaska. This report has just been published as a public document by the Federal Power Commission, Washington, D. C.

The two National Forests in Alaska, declares Mr. Dort, can produce about 2,000,000 cords of pulp wood every year for all time under scientific forestry practices. Translated into paper this means an output of 5,000 tons of paper every day. Excellent water power sites are abundant in southeastern Alaska, the report states.

NEW ACID-RESISTING MATERIAL

A new acid-resisting material, called plombit, is creating considerable interest among European chemists. It is described as a kind of an asphalt. The new material, while first marketed in Germany, is said to be the invention of the Russian chemist, Albert Flexer, director of the Watproof A.-G., of Prague, Paris, and Barcelona. From the patent specifications it is shown to be a combination of hard rubber and oleic acid, with concentrated sulfuric acid and free sulfur added. It has a high melting point — about 130 degrees C. —, is odorless, and made in a variety of colors. It is adopted for lining acid tanks as well as for protecting machinery

(Continued on page 42)

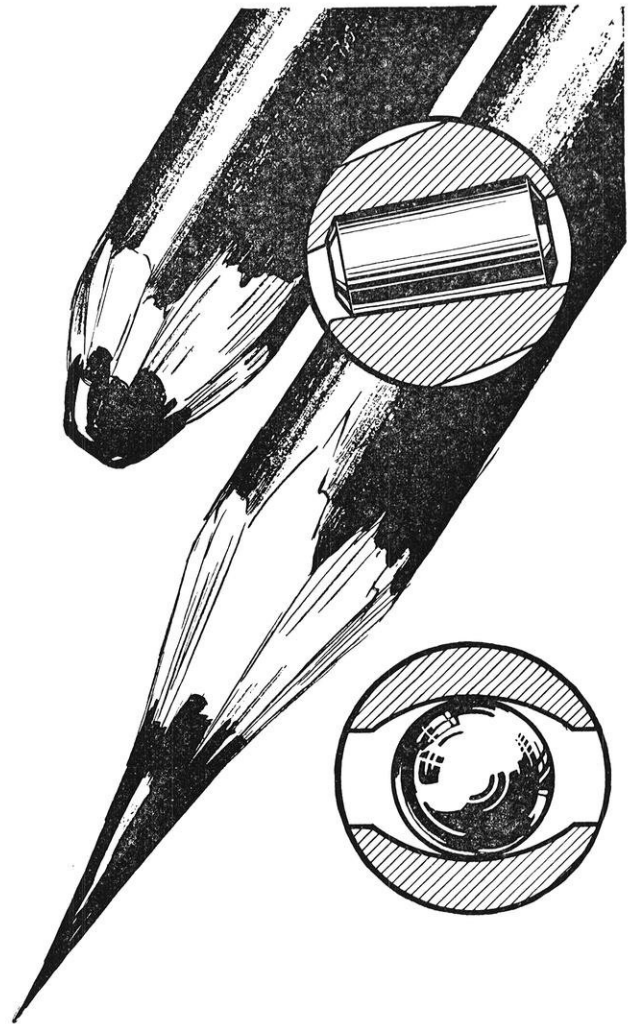
THE surest thing about a pencil with a fine, long point is that the fine, long point will soon wear off. Five minutes of rapid note-taking, and you're down to where the point is broad, and *there* the lead lasts much longer.

Here, in principle, you have a key to the superiority of a roller over a ball bearing.

Two surfaces, separated by a ball, must rest upon points in the circumference of the ball. They rest upon points because there's nothing else in the circumference of a perfect ball but points.

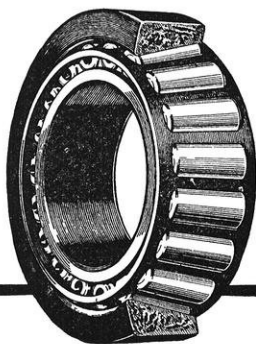
Two surfaces that are separated by rollers, however, rest upon the broad length of the surface of the rollers.

Although made of steel instead of graphite, and thus infinitely more enduring, the difference in life between a roller bearing and a ball bearing is nevertheless typified by the sharp vs. dulled pencil point. The broader the surface over which the load is distributed, the less rapid the wear—and the longer the life of the bearing.



Timken Bearings, in addition to being roller bearings are also *tapered* roller bearings. Because of the taper, they withstand the loads which are called "end thrust," as well as those directly at right angles to the axis in which the bearing is mounted, called "radial load." Only tapered bearings have the capacity in one bearing to withstand both these loads.

The Timken Roller Bearing Company
CANTON, OHIO



TIMKEN

Tapered

ROLLER BEARINGS

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A Memo for Roads Scholars

THERE will always be engineers who will be attracted by every novelty, anxious to try every new experiment. Let them gamble, if they wish, with their reputations—play safe with your own.

When you come to your first paving project, advocate brick, specify brick, pave with brick and continue to do so—then you'll never have a skeleton in your paving closet. Remember this—no vitrified brick pavement ever wore out from the top down. Get your sub-construction right, surface it with brick and don't worry. (You won't need to.)

- Alton Brick Company
Alton, Ill.
- Binghamton Brick Company
Binghamton, N. Y.
- Cleveland Brick & Clay Company
Cleveland, Ohio
- Clydesdale Brick & Stone Co.
Pittsburgh, Pa.
- Coffeyville Vitrified Brick & Tile Co.
Coffeyville, Kans.
- Collinwood Shale Brick Company
Cleveland, Ohio
- Francis Vitric Brick Company
Boynton, Okla.
- Georgia Vitrified Brick & Clay Co.
Augusta, Ga.
- Globe Brick Company
East Liverpool, Ohio
- Hisylvania Coal Co.
Columbus, Ohio
- Hocking Valley Brick Company
Columbus, Ohio
- Independence Paving Brick Co.
Independence, Kans.
- Metropolis Paving Brick Co.
Pittsburg, Kans.
- Metropolitan Paving Brick Co.
Canton, Ohio
- Mineral Wells Paving Brick Co.
Mineral Wells, Texas
- Moberly Paving Brick Company
Moberly, Mo.
- Murphysboro Paving Brick Co.
Murphysboro, Ill.
- Nelsonville, Brick Co.
Nelsonville, Ohio
- Peebles Paving Brick Company
Portsmouth, Ohio
- Purinton Paving Brick Company
Galesburg, Ill.
- Southern Clay Mfg. Company
Chattanooga, Tenn.
- Springfield Paving Brick Company
Springfield, Ill.
- Sterling Brick Company
Olean, N. Y.
- Streator Clay Mfg. Company
Streator, Ill.
- Thurber Brick Company
Ft. Worth, Texas
- Toronto Fire Clay Company
Toronto, Ohio
- Trinidad Brick & Tile Company
Trinidad, Colo.
- Veedersburg Paver Company
Veedersburg, Ind.
- Western Shale Products Company
Fort Scott, Kans.
- Westport Paving Brick Company
Baltimore, Md.

The ABC of Good Paving

ASPHALT for *Filler* because it makes the traffic-bearing surface a water-proof, flexible armor not subject to the cracks which follow rigid slab construction, and because repair costs are insignificant where each brick is an easily removable unit.

BRICK for *Surface* because it furnishes the best surface for traffic; *hard*, but not brittle—*tough*, but not rough—*dense*, and non-absorbent—*smooth*, but not "slick;" because its fire-hardened toughness resists wear and tear so sturdily that upkeep expense is squeezed to a minimum and because any margin of higher first-cost is speedily offset by low maintenance, long life and uninterrupted service.

CONCRETE, CRUSHED ROCK, CRUSHED SLAG OR GRAVEL for *Base* because some one of these bases meets any conceivable sub-soil condition, and with a bedding course of sand or screenings makes the best sub-structure yet developed for modern street or highway traffic.

Send for free handbook, "THE CONSTRUCTION OF BRICK PAVEMENTS."

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION
Engineers Bldg. Cleveland, Ohio



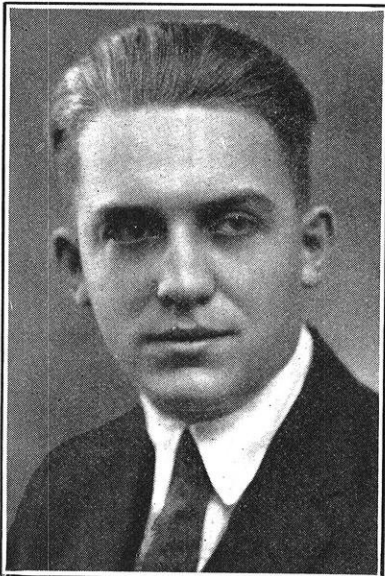
OUTLAST THE BONDS
NATIONAL PAVING BRICK MFRS. ASSN., CLEVELAND, O.

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ALUMNI NOTES

SENGER WINS WESTINGHOUSE PRIZE

For several years the Westinghouse Electric and Manufacturing Company has offered a prize for the development of new ideas of design or construction in connection with certain types of steam turbines. The offer was open to graduate mechanical engineering students, and properly qualified seniors in Sheffield Scientific School, Yale University. Ideas of design in connection with blading and rotor, nozzles, coupling, bearings, lubricating system, or mechanism for control of steam flow were wanted. The purposes in offering the prize were to cheapen methods of production, to economize by simplification of design, and to familiarize students with Westinghouse steam turbines.



W. I. SENGER '23

He wins Westinghouse prize in turbine design

stant and other conditions, and a brief description of original designs with reasons for adoption were to accompany the drawings.

The work was judged from several standpoints: application of theory, quality of design, originality, arrangement, neatness, and quality of written report. It was, therefore, necessary to present a real piece of work; one which represented careful study and application.

Mr. Senger's designs were considered the best submitted, and he was awarded the first prize of two hundred dollars, and the second prize of one hundred dollars.

FORMER INSTRUCTOR AIDS IN MINE RESCUE

Among those who played an important part in the relief work following the Castle Gate, Utah, mine disaster, in which 171 men were killed, was H. T. Plumb, e '01, and former instructor of Wisconsin. Mr. Plumb, was on a special train from Salt Lake City which carried officials, doctors, federal and state mine inspectors, and emergency supplies to the scene of the explosion.

Though in his official capacity as engineer of the Salt

Lake City office of the General Electric Company, he was not called upon to do so, Mr. Plumb felt that he should do whatever possible to assist the rescue workers. His part happened to become that of establishing communication with those who were risking their lives in the wrecked mine, and keeping a sort of general store where the rescue workers were supplied with dry clothing, lamps, and necessary supplies.

Despite the bitterly cold wind Mr. Plumb set up his first telephone on a fence near one of the mine entrances. This was connected with the portable phones which the rescue parties carried. By means of the phone the workers were directed. With several fires smouldering in various parts of the mine there was danger of a second explosion and the lives of the men depended on telephone orders being carefully carried out. The telephone exchange became an extremely important link in the work of clearing the mine of gas, debris, and dead bodies.

After his work had started a canvas shelter was erected, finally a stove was added, which brought comparative comfort. In addition to maintaining communication, and taking charge of the distribution of supplies at the entrance where he was working, Mr. Plumb found time to "make small talk" with the men underground when nothing important was going on. These telephone conversations went far toward keeping up the morale of the men.

Mr. Plumb has much praise for the work of all who assisted in the rescue work. "I witnessed many acts of unselfish bravery and courage, but mostly a vast blur of fortitude and grief borne in patient silence," he said.

CIVILS

Elmer W. Becker, c '24, after spending six weeks at Camp Custer to complete his R. O. T. C. requirements, took a position as junior engineer in the water department of the City Engineer's office at Milwaukee.

Byron Birl, C. E. '15, gives his address as 1602 Second Ave., North, Fort Dodge, Iowa.

J. R. Butler, c '22, is in the bridge department of the C. & N. W. Ry. Address 1449 Granville Ave., Chicago. He writes: "My first position after graduation was with the Wisconsin Highway Commission, where I worked for a year and one-half. Upon leaving the Commission, I went to the Bridge Department of the C. & N. W. Ry. Here I am today in charge of the highway and street bureaus of this department. My work pertains to design of overhead highway bridges, reinforced concrete street subways, grade crossing eliminations study, and road design of approaches to bridges."

Harry D. Blake, c '11, locating engineer with the Wisconsin Highway Commission, and Mrs. Blake, were severely injured on Oct. 13, when an automobile in which they were riding was struck by a train. Mr. Blake was not driving. The accident occurred between Aurora and Virginia, Minn., at 11 a. m. Mr. Blake, who was the more seriously injured, was taken to the hospital at Sudan and later removed to the Burns & Christianson hospital at Two Harbors, Minn. He expected to leave the hospital on November 2.

David L. Fairchild, c '90, writes that he has left Elkhorn, Wis., and is now located at 1312 Douglas Ave., Minneapolis, Minnesota.

R. D. Foxon, c '24, gives his home address as 207 Bridge Street, Northampton, Mass.

Frank M. Kennedy, c '08, is with the U. S. Air Service in Europe. He was sent to the Zeppelin Airship Factory at Frederichshafen, Germany, two years ago by the Air Service. Since that time he has been directing the construction work on the new super air ship, Z R-3, which the German Government has been building for the United States in accordance with the Versailles Treaty. The success of the flight has been eagerly received by Wisconsin students and graduates alike, since it adds another link to the chain of worth while achievements that our alumni and faculty are forging. Mr. Kennedy holds a Major's commission in the regular army.

Harry L. Mc Donald, c '04, is living at 6685 Hollywood Boulevard, Hollywood, California.

Geo. C. Reed, c '24 after finishing his Summer Survey work at Devil's Lake, Wisconsin, drove to Little Deer Island, Maine, with his Ford and dog, Laddie. He reports a most enjoyable summer and gives his permanent address as 83 Brattle Street, Cambridge, Mass.

Lawrence T. Sogard, c '24, is employed by the Henkel Construction Company of Mason City, Iowa, in building concrete roads in central Illinois. He writes, "I am buried (alive) in central Illinois with the Henkels engaged in amassing votes for Len Small by laying his famous "Hard-Roads." No one hereabouts calls it pavement or concrete; it is Hard-Road and we are the Hard-Road gang. Therein rests a fine distinction; are we the Hard-Road gang or the hard road-gang? An inspection of the individual members might lead one to decide that we are both. We hope to complete this contract, about 12 miles, by December; after that I expect to return to civilization for the winter."

ELECTRICALS

Bohman, R. B. c '23, was married this summer to Miss Louise Fuerst of Milwaukee. The ceremony was performed in Milwaukee on August 28. After a two week's honeymoon in northern Wisconsin, the couple returned to Chicago, and are now living at 6916 Dante Avenue. "Bob" is a member of Theta Xi fraternity, and while in school was active in student affairs; he served for a time as Campus Notes Editor of the ENGINEER. Since graduation he has been employed with the Folwell-Ahlskog Co., engineers and constructors.

MINERS

Stuart C. Lawson, min '17, is employed by the Otis Elevator Company of New York as Chief Estimating Engineer. He writes that Eugene Vegneson, '17, has also accepted a position with that company.

J. V. Mangold, ex min '22, has returned from a years experience with the New York-Honduras-Rosario Mining Co. as mining engineer and has re-entered the University.

T. D. Jones, min '22, was married to Miss Lulu Mann of Yankton, South Dakota, September 3, 1924. Jones is Efficiency Engineer and Assistant Superintendent of blast furnace for the Omaha plant of the American Smelting and Refining Co. The couple reside in Omaha.

W. A. Emanuel, min '20, was married to Miss Kathryn Larson of Anaconda, Montana, on September 9, 1924. They will reside in Anaconda where Emanuel is employed as research engineer for the Anaconda Copper Mining Co.

G. H. Larson, min '23, M. S. '24, is in the employ of the United Verde Copper Mining Co., at Jerome, New Mexico.

Clarence F. Suhm, ch '21, writes that he is no longer with the Forest Products Laboratory at Madison and gives his new address as 655 Superior Street, Milwaukee.

MECHANICALS

Armin Elmendorf, m '19, visited friends on the Campus and at the Forest Products Laboratory on September 25. Mr. Elmendorf recently returned from England where he was employed as a consulting engineer by Vicker's Ltd. of London. He is now engaged in consulting work in Chicago.

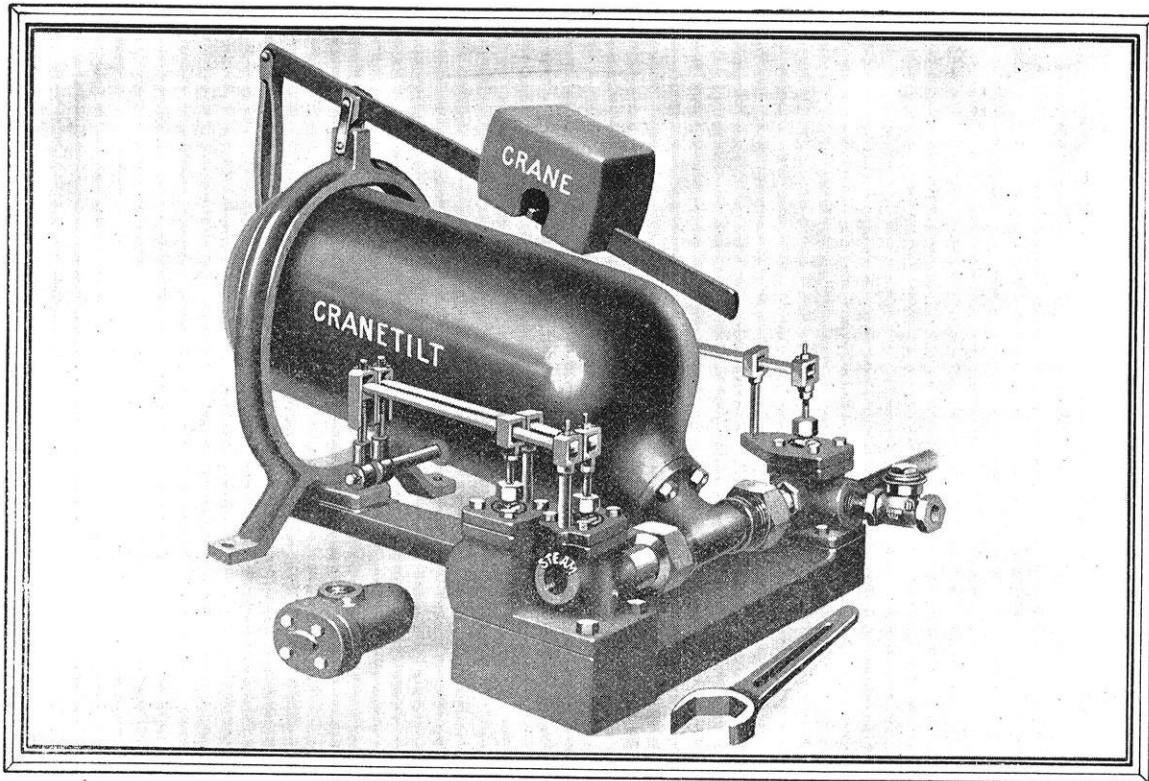
Frederick W. Ives, m '09, was killed in a railroad accident last July together with Fred Walter McNair, formerly of Fennimore, Wis., and John Hoffman Dunlap of Harrisville, N. H. Mr. Ives was born in 1884. He graduated in the Mechanical Engineering course from the University of Wisconsin in 1909 and served for one year as student assistant and instructor in the Department of Mechanical Drawing. In the following year he accepted a position as instructor in Engineering Drawing at Ohio State University. In 1914 he was made Assistant Professor of Agricultural Engineering, and in 1920 he was made head of that Department, which position he retained until the time of his death.

Besides the performance of his pedagogical duties he found ample time for the pursuit of literary work. In addition to writing several books, he held the positions of Corresponding and Contributing Editor for the Farm and Fireside Journal and Ohio Farmer, respectively. Mr. Ives was also an active member of A. S. A. E., and was elected President of that organization at the last annual meeting held at Lincoln, Nebraska, in June, 1924.

Royal L. Meyer, m '20, is still with Sargent and Lundy, Chicago. He is at present in charge of the design of the Twin Branch Power Station. His address is 1454 Belle Plaine Avenue, Chicago, Illinois.

Herman K. von Kaas, m '24, is employed by the Milwaukee Dairy Supply Company. He writes: "After a 10,000 mile automobile trip through the west and south, I finally settled down to work. I am working with the Milwaukee Dairy Supply Company, here. Just now I am out on the assembling floor trying to learn how to build dairy machinery. At present the company is busy getting some new models in shape for the National Dairy Show, which is to be held in Milwaukee the week commencing September 27. The firm specializes in an automatic capper and filler which is made in several sizes. The smallest is operated by hand. The largest model fills and caps 80 bottles a minute. The bottles are dumped in by the case and they come out of the machine filled and capped ready to be put back into the case which has in the meantime traveled to its new position over the top of the machine. Speed and cleanliness are the great advantages of the machines, but to see some of them come back for repairs, looking as if they had never been cleaned since they left the factory, makes one believe that the first named quality is the most important. However, since I am not trying to sell you the machines, I had better change the subject. But, to close it, I am quite enthusiastic about the work, and believe that I have a good chance to get somewhere with it."

Richard F. Knott, m '17, and his wife, Dorothy Basset Knott, '21, visited in Madison in the latter part of September. They were accompanied by their daughter, Dorothy junior. Dick is employed by the National Biscuit Company as Assistant Purchasing Agent for their Carton Factory which is located at Marseilles, Illinois.



CRANETILT THREE-VALVE, LIFTING-TYPE STEAM TRAP

WHAT IS A STEAM TRAP?

A successful steam trap should be a passageway for water and a barrier to steam. It prevents the loss of any steam while it disposes of the accumulated condensation from pipe-lines and headers. Or drains receivers, drip pockets or steam using appliances. It is automatic, performing its important function without attention.

Steam traps of the right type, properly arranged, will return hot condensation directly to the boilers as pure feed water. Conserving the "heat of the liquid" of this condensate, they effect large fuel economies. They

are the most economical devices on the market for boiler feeding. Steam traps can also be used to draw condensation from low pressures or vacuums, discharging directly into a higher pressure, and metering the discharge if desired.

Cranetilt traps perform these and similar functions in many important power plants, in chemical plants, paper mills and oil refineries. Their operation is fully described in a Crane publication entitled "Condensation." We will be glad to send a copy to any engineering student who writes for it.

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Home Cooking Reasonable Prices

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740 Langdon Street

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Engineers will find us fully equipped with clothing and footwear, suitable to their needs, at prices that are interestingly low.

Army Shirts, all wool, double elbow - **\$2.75**
 Boots, water proof moccasin, 16" -- **\$6.95**
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 rubber heels ----- **\$3.95**

ARMY BREECHES

Button or Lace Bottoms — Khaki,
 Moleskins, Corduroy, Wool,
 and Whipcord ----- **\$1.75 & up**

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Large assortment of leather jackets, wool or sheepskin lined, with half or full belts.

OVERCOATS

All wool dress overcoats, in the latest styles, at very reasonable prices.

Slickers, shirts and many other items too numerous to mention. Come in and see for yourself.

MADISON ARMY STORE

126 E. Main St. on Corner

Badger 7719

ENGINEERS — An afternoon of surveying makes you pretty hungry — but we can satisfy any appetite —

THE COLLEGE LUNCH ROOM

1200 University Ave.

We wouldn't try to write a letter with a paint brush.

Of course not. We would use a pen and the best that we could get at that.

Why not get a good fountain pen. Come in and look our complete stock over. You will find that we have a pen that just suits you.

We also repair all makes of Fountain Pens.

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The Co-Op is Headquarters for Engineers' Supplies

The supplies you'll find at the Co-op are first quality manufactured by:

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All slide rules, drawing instruments, drawing paper, T squares, triangles and drawing boards are those recommended by the College of Engineering. Buy them on your Co-op number.

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THE CO-OP

E. J. Grady, Mgr.

Vega Banjos and Gibson Mandolins at HOOK BROS.

ATHLETICS

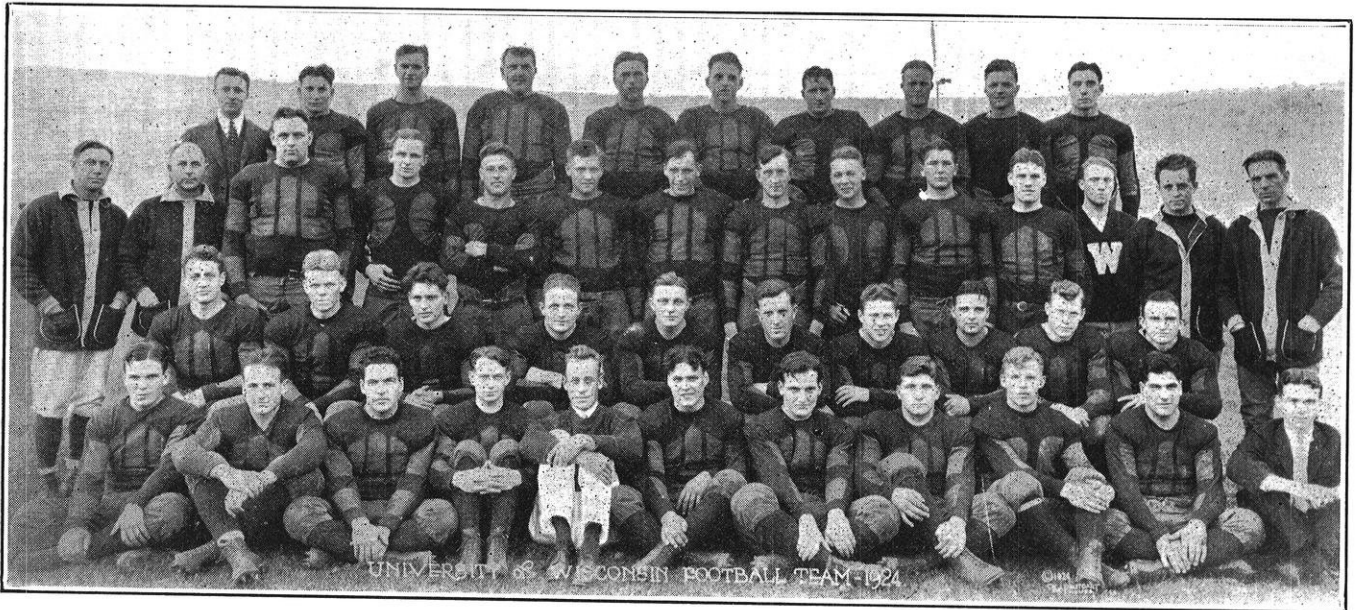
G. H. ABENDROTH

FOOTBALL

After what looked like the beginning of a successful season, Wisconsin's football championship aspirations took a decided drop. North Dakota and Ames each fell before our Badgers, although Roberts of Ames did his best to bring victory for the boys from Iowa. With the Harmon brothers, Harris, McAndrews,

to plunge through our line at will and didn't stop until Schutte had plunged for a touchdown. Another tie was placed on the books for our team, but ties weren't so bad if we could beat Michigan, the team that had beaten us the year before.

Michigan, with an overwhelming defeat by Illinois and "Red" Grange chalked up against her, was looked



THE BADGER FOOTBALL SQUAD

Williams, and Larson in the backfield our team looked unbeatable — on paper. Little Coe came up from Iowa and gave us our first scare, and made us realize that although we might be good there were others just as good. The boys from the Hawkeye state went back to their little university with a very chesty feeling prompted by a 7 to 7 tie game with Wisconsin.

The next week brought our traditional enemies down from the north. The odds were against us, and Minnesota, with a heavy line and a speedy backfield was primed to give their 2,000 husky rooters the treat of seeing the Badgers, traditional enemies, trailing in the dust.

Our team, with the 7 to 7 tie with Coe staring them in the face fought to vindicate themselves and swept Minnesota off their feet during the first half, but during the first half only. After making their touchdown the boys in Cardinal saw the northerners wake up to the fact that they were playing football. Lidberg and Schutte, with the aid of their heavy line seemed

upon as easy prey, but she turned out to be quite the opposite. After sixty minutes we found ourselves on the short end of a 21-0 score. Forward passes again defeated Wisconsin. Our line showed its spirit by holding Michigan for five downs on the three yard line, but the whole team showed its weakness on forward pass defense.

With two of our conference games out of the way and a great big zero chalked up in our "won" column, it is hoped that a few victories can be placed to our credit. Notre Dame with its celebrated Knute Rockne, Iowa, and Chicago with Coach Stagg at the helm are quite a formidable aggregation of teams, and if Wisconsin manages to eke out a few wins to add to her pre-Notre Dame record, she will have done well.

CROSS COUNTRY

Coach Meade Burke started his cross country aspirants on the road for a hard grind before the registrar

(Concluded on page 43)

CAMPUS NOTES

E. C. M. A. MEETS HERE

Engineering College Magazines Associated held their annual convention here on October 24 and 25. Representatives of nineteen engineering college magazines were present. The convention opened with addresses of welcome by President Birge and Prof. Volk. The main topics of discussion of the convention were style of make up and standards of practice. Professor Hyde of the School of Journalism and Professor Gardner of the School of Commerce addressed the convention on these topics. A banquet in honor of the delegates was held Friday evening at the Luther Memorial Church. Professor Hopkins of the College of Agriculture spoke on the ethics of college publications. Professor Van Hagan was elected chairman of the Association for the next two years.



CONVENTION DELEGATES AT WISCONSIN

Among the forty odd magazines with which the Wisconsin Engineer exchanges, there is one publication, The Revista Polytechnica, that is more or less of a puzzle to us. It is published by Gremio Politechnico de S. Paulo, Brazil. We are waiting for some engineer, who knows his Spanish, to come along and tell us what is in it.

Have you been to the new clinic since it is in its new home? They still have their old habits, and it is just like olden times to go out there and wait around for two or three hours while the doctors visit with each other.

Walter L. Radke, junior civil, has withdrawn from school to take a position in the railway offices of Schlubach & Sapper Company at Livingston, Guatemala.

SPEECH AMPLIFIERS AT STADIUM UNSUCCESSFUL

The speech amplifiers, which were tried out at Camp Randall by the physics department, were not successful because of lack of volume.

Before the game the amplifiers could be heard in any location of the stadium, but after the crowd had formed, it was impossible to hear the speaker at the fourth section away from the apparatus.

The theory was advanced that the crowd damped the speech waves. This condition was anticipated by the physics department, but the amount of this effect could not be calculated before the first trial.

The apparatus was especially designed for the test. It consisted of three direct current generators driven by an alternating current motor. The speech was amplified by a Western Electric amplifier and distributed by six wooden horns.

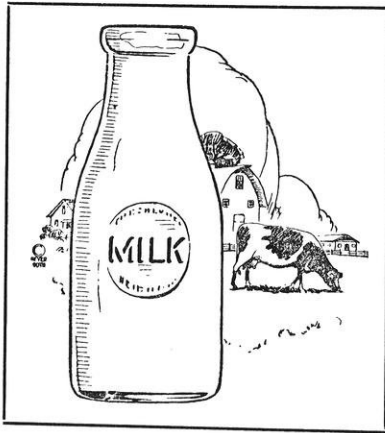
If this test had proven successful, amplifiers would have been used at the Homecoming game. The value of these amplifiers at football games is appreciated by Professor Jones, but he does not feel justified in spending the necessary money for them at this time. Next year the experiment probably will be tried again, but with more power on the amplifiers.

J. B. Kommers, of the University of Wisconsin, has been assisting L. S. Marks in editing his new book, entitled, "Marks' Mechanical Engineers' Handbook."

SURVEYING COURSE CHANGED

Sophomore surveying, Topographical Engineering 3 and 104, is being revised by Prof. Ray S. Owen. Plane table work, triangulation, and sextant and solar observations constituted the first semesters' work in the past, with topography by stadia and city platting for the second semester. There were several objections to this arrangement. The weather during the first semester of the school year is often unfavorable and the days are too short for solar observations. This resulted in grades of incomplete for many students. All of the second semesters' work required mapping and tracing near the end of the semester when students are all ready pressed for time. To eliminate these objections, city platting and solar work will be interchanged with the result that the first semester will have less field work and more drafting while the second semester will be mostly field work.

A college man is one who tells the time of day by how far down his socks have slipped.



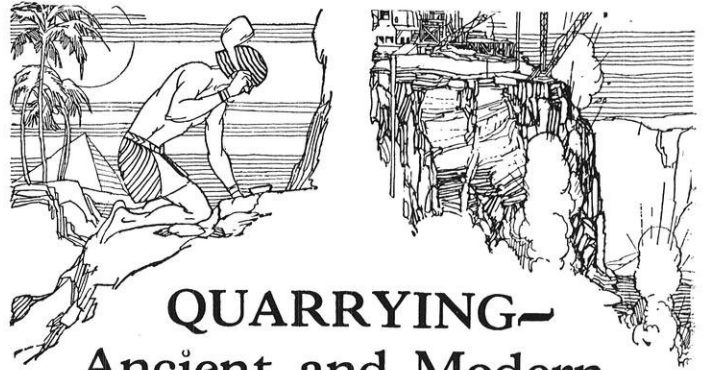
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THE quarrying of stone reaches back into the twilight of antiquity. It was practiced by peoples whose only records are written in their crumbling temples and weather-worn monoliths. From earliest times stone-cutting has been a well-understood art.

Quarrying today is an important industry. Stone finds a thousand uses in our complex industrial structure. And in stone, architectural genius creates its most eloquent expression.

But the modern quarryman has at his disposal a force undreamed of by the ancients. Explosives have taken the place of arduous hand labor. Now, whole hillsides are blasted almost as easily as one block could be cut by hand tools alone.

Quarrying methods vary with the specific problem at hand. The quality and condition of the stone, the purpose for which it is to be used, and the general quarry conditions determine the type of explosives to be employed.

Du Pont manufactures an extensive line of explosives. Among those recommended for quarrying are: Red Cross Extra or du Pont Extra; Du Pont Straight Nitroglycerin; Red Cross, Du Pont, Repauno and Forcite Gelatins; Arctic Special. Also Du Pont R. R. P.—a "low powder" of granular formation.

The du Pont Company manufactures the proper explosive to do each type of blasting best, at least expense.

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SENIOR CIVILS SUFFER ELUCIDATION

On Wednesday morning, October 29, our senior civils started out bravely to see some of the world. The pleasure trip, technically called an inspection trip, was escorted ably by Professors Corp, Kinne, Ward, and Instructor Rabbit. The function of the escorts was to show the embryo civils the different plants and "places" that are of interest to engineers. According to latest dope, the "places" were more varied in their nature than were the manufacturing plants.

The first morning was utilized by the inspection of bridges. The City of Milwaukee has a rare variety of bridges, — old bridges, new bridges, obsolete bridges, and bridges that stand on both ends. After the boys had seen all that the big city had to offer in the line of finished constructions, they pervaded the plant of the Wisconsin Bridge Works to see how some of the pieces were put together. Other salient features of the trip include contact with the garbage incinerator, the sewage disposal plant, Allis-Chalmers Manufacturing Company, and the North Point and Riverside Pumping Stations.

On the afternoon of the last day Prof. L. S. Smith took charge of the expedition. After luncheon at the Republican House they "flivvered" about the fair city to see and feel the effects of both good and bad roads.

It is said that the social life in Milwaukee was quite strenuous, but all of the boys are attending classes regularly now.

APPLIED COST ACCOUNTING

A prominent Madison tailor had received and partially recovered from a few garage bills. Some days later the garage man had the tailor sew on a button. Following is the bill:

Sewing on button	\$.15
Thread03
Button06
Labor, 1/4 hour30
Removing old thread07
Labor, 1/8 hour15
Needle02
Beeswax01
Knotting thread01
Labor, 1/6 hour20
<hr/>	
Total	\$1.00

Boss: "Can you use logarithms?"

Applicant for job: "No, I never worked in a lumber yard."

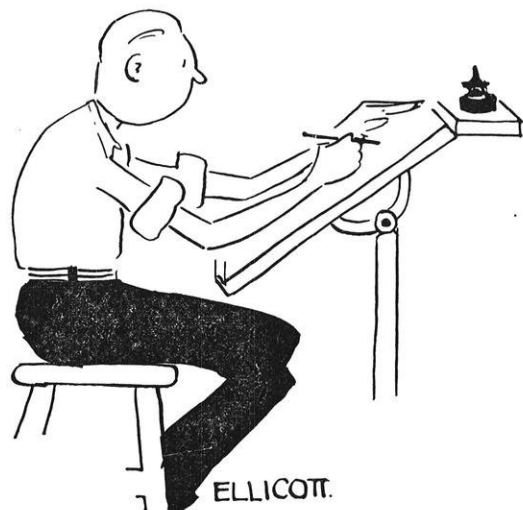
A LUCID INTERVAL

Schmidt: "You must not like that instructor, but you must admit that he's a hard worker. He throws himself into anything that he undertakes."

Smith (still sore): "I wish that he'd build a garbage incinerator."

The engineering college does not seem to inspire many of the miscalled weaker sex to higher education along the engineering lines. Last semester there were two co-eds enrolled in mining engineering, but during the summer one of them fell by the wayside, as "Grace," the celebrated civil of two years ago did. Micky Hahn, min'27, (F.2757) however, is still true to the college, and she seems to recognize the serious aspect of the engineer's career by her h. b. attire. The engineers claim absolutely no responsibility for the report that she is majoring in the gold-digging side of mining engineering.

It is said that, of the thirty-five leading railroads of the country, eleven have presidents recruited from the engineering profession. The twenty-four remaining positions should be the means of attracting 10,000 ambitious young men to the engineering schools this fall.



THE SOPHOMORE CIVIL AS HE DRAWS RAILWAY CURVES, CONICAL PLANES, FLAT SPHERES, AND ROLLER BEARINGS. LOOK HIM OVER.

WHAT DO THEY THINK OF US DOWN EAST?

Professors Hool and Kinne are the editors of a series of books on building construction. The books are described as having been prepared by a staff of specialists. During the summer Professor "Bill" received a letter from a library in New Jersey requesting information about the book on reinforced concrete "by a staff of Socialists."

POLYGON DONATES

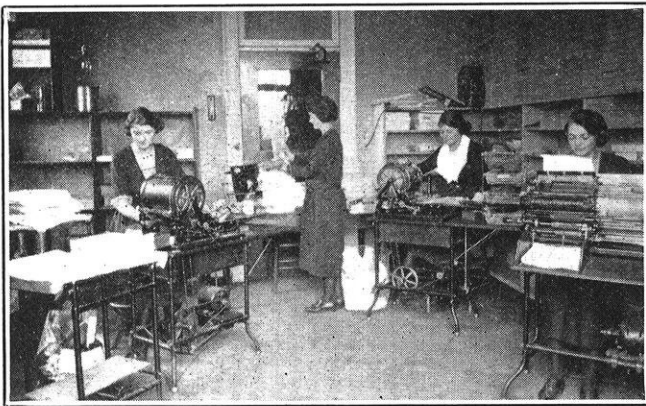
In the final meeting last year the Polygon Engineering Society donated \$40 to the Memorial Union. The money represented the profits from the Engineer's dance which was held May 3. Fifty dollars, the proceeds left over from the St. Pat's parade fund, was turned over to Dean Turneure as a loan fund for needy engineering students.

EXTENSION NOTES

The following sophomore class officers have been elected in the Extension Division day classes in Milwaukee: President, James Arter; Vice-President, George Heimerl; and Secretary and Treasurer, Viola Schroeder.

A Student Council has been proposed and a charter is being drawn up for submission to the faculty for approval. The following students have been selected as members of the Student Council: Earl Fischer, James Arter, Wilma Klevay, Walter Wegner, Oscar Schottlander, Ted Blazel, and Howard Bast.

On October 17, the annual Tug-of-War between the freshman and sophomore classes, was held at Washington Park. The freshmen succeeded in pulling the entire sophomore class through one end of the lagoon, a distance of forty yards.



MIMEOGRAPH ROOM

University Extension Division — Madison

Among those who attended the dedication of the new electrical engineering building at the University of Minnesota was Prof. C. M. Jansky of the department of electrical engineering.

Dean Louis E. Reber is a member of a Committee on Engineering Extension of the Land Grant College Association. A study of engineering extension in the Land Grant Colleges has been made, and a report on the work being done will be made at the November meeting to be held in Washington, D. C.

A number of executives in several of the large industrial plants in Milwaukee are doing special research work in theoretical metallurgy in a new course offered at the Extension Division in Milwaukee under the direction of Prof. R. S. McCaffrey of the mining and metallurgy department of the College of Engineering. Prof. McCaffrey is giving this advanced work in metallurgy with reference to the solution of certain industrial problems.

Prof. Ben G. Elliott attended the meeting of the American Foundrymen's Association recently held in Milwaukee.

A new course on "The Slide Rule and Its Uses" is being developed by the mechanical engineering department.

WHAT OUR STUDENTS ARE DOING

Djang Djeu Ru, Instructor in the North China Baptist College of Hwanghsien, Shantung, China, has recently registered for a course in university physics.

Mr. William Murphy, student in civil and structural engineering is employed in the Land and Survey offices at Canberra, New South Wales, Australia, where plans for the new Australian Capital are being prepared.

The following extract is from a letter received from a former life prisoner at the State Prison. He was pardoned two years ago.

"Dear Professor:

When I enrolled in my first University Extension course twelve years ago I began a new life.

My instructors answered all my questions cheerfully and in the most simple manner. Long letters, not simply letters ground out by mimeograph, but letters full of hope and advice came to help me solve the difficulties that were holding me back.

Now, anyone can read books and get second hand opinions from them — that is only letting someone else do your thinking for you. The University Extension Division did more than that for me. It taught me to think and to form my own opinions from the many studies surrounding me. Every hour of work on my courses brought me nearer to my ambition. You know how many hours it took me to get where I am today, don't you?

I can say with sincere feeling that the University Extension Division was the guiding hand that led me from the utter depths of sorrow and misery to the light and freedom of a new life. It has given me the strength, courage, and knowledge that have made it possible for me to see life, the cheerful light of day, without looking through bars; and it has been the voice that led me and guided me when everything and everyone seemed against me.

Finally, today I stand before men equipped with a knowledge that enables me to hold my place among men, to do the large variety of work necessary in my vocation, and to do it right.

Sincerely yours"

BRINGING MORE DAYLIGHT INTO INDUSTRIAL BUILDINGS.

Dr. George M. Price, writing on "The Importance of Light in Factories," in "The Modern Factory," states: "Light is an essential working condition in all industrial establishments, and is also of paramount influence in the preservation of the health of the workers. There is no condition within industrial establishments to which so little attention is given as proper lighting and illumination. Especially is this the case in many of the factories in the United States. A prominent investigator, who had extensive opportunities to make observations of industrial establishments in Europe as well as in America, states: "I have seen so many mills and other works miserably lighted, that bad light is the most conspicuous and general defect of American factory premises."

"My own investigations for the New York State Factory Commission support this view. In these investigations it was found that 36.7% of the laundries inspected, 49.2% of the candy factories, 48.4% of the printing places, 50% of the chemical establishments, were inadequately lighted. There was hardly a trade investigated without finding a large number of inadequately lighted establishments."

Inadequate and defective lighting of industrial buildings is not confined to the establishments in New York State alone. The same conditions prevail in most sections of the country.

Such conditions as mentioned above are entirely opposed to the laws of health, sanitation and efficiency. Wherever poor lighting conditions prevail, there must be a corresponding loss of efficiency and output both in quality and in quantity. American industry is not using nearly enough daylight and sunlight in its buildings. Every endeavor should be made to use as much as possible of daylight for lighting purposes. To obtain this it is of course necessary that the rays of daylight and sunlight are permitted to enter the interior of the buildings as freely as possible, with the important modification that the direct rays of the sun must be properly diffused to prevent glare and eyestrain. A glass especially made for this purpose is known as Factrolite, and is recommended for the windows of industrial plants. Windows should be kept clean if the maximum amount of daylight is to pass through the glass, but the effort will be well repaid by the benefits secured.

In the presence of poor lighting, we cannot expect men to work with the same enthusiasm as when a well lighted working place has been provided. The physical surroundings have a deep effect upon the sentiments of the employes, and where bad working conditions are allowed to prevail, there is invariably a lessening of morale and satisfaction created thereby. Neglecting to utilize what nature has so bounteously provided, daylight, and which is so essential toward industrial efficiency, we have an instance of wastefulness, but now that the importance of good lighting is becoming recognized, undoubtedly more attention will be given by progressive industrial employers to furnishing the means which are essential for their workers to secure and maintain the efficiency, which counts for so much in the success of any industrial concern in this competitive age.

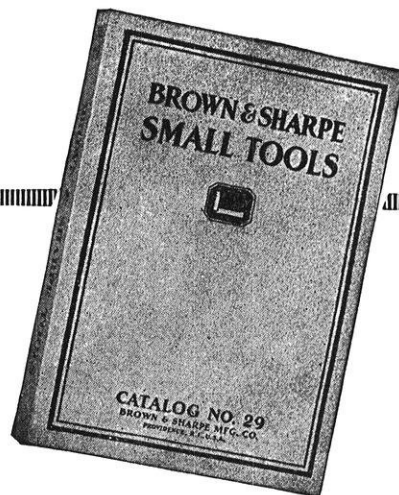
If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

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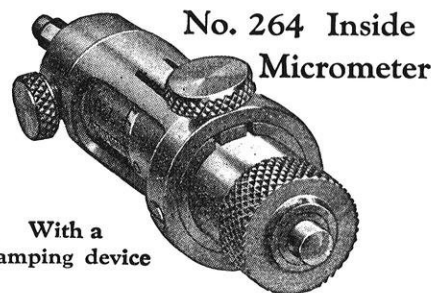
A sound basis for accurate measurements

WHEN you stop to consider what machinists' tools mean to the various metal working industries, their importance becomes apparent.

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FOLLOW THE CROWD

to

PETE'S LUNCH ROOM

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Mr. Samulus Amalleff has recently resigned from the American Bridge Co. and has accepted a position as instructor in civil engineering at the University of Washington.

Mr. Edgar W. Strong, Bremerton, Washington, writes that he has just returned from a surveying trip of several months in Western Alaska. Mr. Strong is a student in civil engineering.

Mr. Adelbert Diefendorf, civil engineering student, was a recent visitor at the Extension Division. Mr. Diefendorf was on his way to accept a new civil engineering position at Rapid City, South Dakota.

Mr. W. E. Wickenden, Director of Investigations for the Society for the Promotion of Engineering Education, was a recent visitor at the Extension Division of the University. Mr. Wickenden is making a study of engineering education for the Society.

MILWAUKEE DAY SCHOOL

The following freshman class officers have been elected in the Extension Division day classes in Milwaukee: President, Earl Fischer; Vice President, Leona Fleischer; Secretary, Ethel Straka; and Treasurer, Malcolm Anderson.

In order to obtain the necessary instruction to manage a gas producer which had not been operating properly, Robert Schenck, La Crosse, enrolled for the extension course on gas producers. After practically completing the course, Mr. Schenck reports "the gas producer has been working perfectly due entirely to the knowledge gained by taking the course." The producer is located at the La Crosse Gas Works.

Prof. Ben. G. Elliott of the mechanical engineering department recently talked before the members of the Milwaukee Real Estate Board on "Fuel Economy and Conservation."

Each year has shown an increase in the number of students who avail themselves of the preparatory course in Algebra for Engineers offered through the Extension Division of the University, but the present year ushers in a much larger number of these students than ever before.

A successful completion of the course is of especial advantage to the freshman in that he has at his command a good working knowledge of algebra at the beginning of his university course. Students not having this knowledge, or failing in the test given shortly after the beginning of the first semester, are required to take a review of preparatory algebra throughout the semester. This means a consequent delay in the completion of the university course, — running over to four and one-half, or even five years.

Furthermore, students who have the necessary one and one-half entrance units in algebra find, in many instances, that so long a time has elapsed since their study of high school algebra that they are glad to avail themselves of an excellent review during the weeks that directly precede the opening of the university.

ENGINEERING REVIEW

(Continued from page 34)

exposed to acid fumes. Sheets of plombit are made for covering metal surfaces and are applied by dipping into the molten plombit and cementing together. The sole European selling rights are held by Fabrik fur Laboratoriums — bedarf Alois Kreidl of Prague.

Canadian Chemistry and Metallurgy

LARGE AMMONIA CHART PUBLISHED

A Mollier chart of the properties of ammonia, 16 by 40 inches in size, has recently been published by the Bureau of Standards. It is intended for use by refrigeration engineers, and embodies in graphical form the data contained in the ammonia tables published by the bureau. Problems in the design and operation of ammonia refrigerating equipment can be solved more quickly and easily by this chart than by the use of the tables, and it is sufficiently accurate for all problems except those in which the most extreme precision is desired.

The data embodied in the chart and in the tables were obtained by the bureau in an extensive investigation of the thermodynamic properties of ammonia, covering the entire range of pressures and temperatures likely to be encountered in engineering practice. Measurements were made with the utmost precision of which a well equipped laboratory is capable, and the work extended over a period of many years. A smaller size of the chart was published more than a year ago. The larger size has been published in response to numerous requests, as it is easier to read and to use because of its larger scale.

ATHLETICS

(Concluded from page 37)

had collected \$15.50 from us poor students. Burke, with several veterans back, has put out a real team this year. George Piper, captain of this year's cross country team, should finish up his university career by beating everything in sight.

Piper placed fifth in the Minnesota meet and fourth in the Michigan meet. The conference meet should find him ready to show his heels to the rest of the field. Besides Piper, Meade Burke has Perry, Schutt, Bergstresser, and Petaja from last year's squad. There is also Ray Kubly, who, running on last year's freshman squad, gave the varsity quite a lot of trouble.

Although the engineers are not represented by any veterans on the squad, there are a few plumbers who are practicing daily with the veterans, and they are doing their best to help Meade Burke produce a successful cross country team. Among these are Harry D. Cohen, a junior, Parker Shafer, a sophomore civil, and Ralph Schilkie, a sophomore mechanical, who last year, though new to the game, was constantly stepping on the heels of Hilberts and Valley. The engineering candidates, especially Schilkie and Cohen, are showing up well and should make a good fight for regular places on the squad.

Meade Burke also has a large freshman squad out, — and a squad which has quite a few anti-lawyers working on it. The wearers of the purple button who are out for frosh cross country are Arthur Rasmussen, Rubard Swallow, W. J. Peterson, W. C. Schuknecht, Karl Johannes, Herbert Schwan, and John Sargent. Earl Ellison, who is probably the most promising of the new men running on the squad, is also an engineer. If sur-

veying and shop can increase the speed of the frosh engineering candidates, the engineers should be well represented on the forthcoming cross country teams.

Wisconsin thus far has defeated Minnesota and Michigan and gives evidence of continuing a successful season. Marquette was completely outclassed although their diminutive star, Shimek, took first place. Kubly took second place in this meet. Perry, Petaja, and Kubly tied for first place in the Minnesota meet which we won by the big score of 17-38.

With the first conference meet out of the way, the Badger harriers ran against Michigan on the shorter four-mile course at Ann Arbor. Although handicapped by the difference in length of the course from our own, and by the loss of Petaja, who was struck by a car and thrown off the road during the run, the Badgers placed the first two men in the finish and won the meet by the score of 23-32.

SWIMMING

Joe Steinauer has his tank ready to give the Badger swimming candidates real workouts every day in the week. With fifty men to work with, Joe should put out a squad which will give Northwestern, with Breyer and her many other stars, some real competition. Joe, however, lost some of his sure point winners last year and will have his hands full replacing them. Czerwonky, last year's captain, who starred in the breast and back strokes, and Norman Koch, varsity diver, two engineers who were always snatching off the first places, will not be under Joe's wing this year.

Candidates from last year's frosh team should help the situation. Herschberger should do as well as Johnny Bennett, and with Gilbrath, who returned to school this last year, Joe should be provided with excellent dash material. Simpkins, this year's captain, should make other divers in the conference step to win first place, and with McGinnis, candidate from last year's frosh squad, Wisconsin should be heard from. Bell, a junior chemical engineer, should make a strong bid for the honors once held by Czerwonky, but will have keen competition from several sophomore breast stroke swimmers, Powell, Horton, Bardeen, and E. Abendroth C. '27.

Steinauer has always had hard luck with the eligibility of his nymphs, but if Dame Fortune and the eligibility committee help, we expect to hear things from Joe's 1925 swimming squad.

Water Basketball is becoming just as much of a sport as the dual meets themselves, and Joe will have a team with a few of last year's veterans back. Joe Feuchtwanger, who was elected captain of the squad, should teach his men all the nice pretty under water tricks which make water basketball interesting. If the doctors at the clinic ever get short of work, a frosh-soph rush should be held as a water basketball game in the tank room. Both freshmen and sophomores will appreciate mother earth again after a few minutes battle in the tank.



COACH BURKE

SOME OBSERVATIONS OF CHINA BY AN ENGINEER*(Concluded from page 27)*

over the mishap. The amount of coal taken on was 3368 tons, and the time required was about ten hours.

In Shanghai probably more than in any other city in China the motor car, motor truck, tram cars, and horse drawn vehicles are taking the place of the coolie. However, the coolie, with his ricksha, wheelbarrow, two-wheeled cart, and bamboo carrying pole transports thousands of passengers and moves many tons of freight daily. I have seen a wheelbarrow coolie wheeling eighteen fifty pound sacks of flour. Five coolies will deliver a ton of coal (2240 pounds) in a two wheeled cart. The coal is sometimes hauled several miles. It is remarkable how much a coolie can carry on his bamboo carrying pole. A foreigner told me that he tried to carry a load that a coolie had just put down, but that he could not raise it off the ground. The coolie grinned, placed a small child on the load in each basket, and walked away without any particular exertion. I have seen coolies with callouses on their shoulders an inch thick and as large as one's hand. In the interior where the roads are not wide enough for a ricksha or where the country is at all hilly the chair is used for carrying passengers. Small boats shown in the picture are used on the creeks and small canals for carrying freight of different kinds. These boats, in which the families live and move from place to place, are often the only home they possess.

CONCRETE AND MECHANICAL APPLIANCES*(Concluded from page 21)*

3. Non uniform puddling and placing in forms. The human element is opposed to thorough puddling and even rock and mortar distribution.
4. Careless or non uniform mixing. Not mixing the proper length of time or using poor machinery with which to do the work.
5. Faulty curing and protection of concrete in its early stages.

Thus are the faults pointed out, and the question which now confronts the Engineer is just how these difficulties will be overcome.

With the overcoming of these difficulties in view, certain manufacturers have produced machine which are intended to solve the problems. Machines exerting three types of force have been introduced. Pressure, tamping, and vibration, have all been used with more or less success. These forces acting singly, rarely effect a maximum result. For a specific example let us take into consideration a barrel of crushed limestone of the usual run of grading. Any material forming interlocking arches will accomplish the same result.

Apply pressure directly downward in a steady manner. Apply pressure on any angle desired, and note that there is little or no change in the volume of aggregate. In like manner tamp the surface of the material heavily with a large hand tamp. Notice that the settlement is very slight. However, if the barrel be

shaken and vibrated at the same time as the pressure is applied considerable reduction in volume will ensue. The vibration seems to destroy the interlocking arches and the pressure assists in the void elimination.

There is a machine on the market at present which tamps concrete, and likewise another which uses pressure. There is also a machine that uses a combination of vibration and pressure. Just what results will be accomplished by the appliances will be something for the Engineering profession to consider. The results should prove interesting.

ENGINEER OR TECHNICIAN?*(Concluded from page 24)*

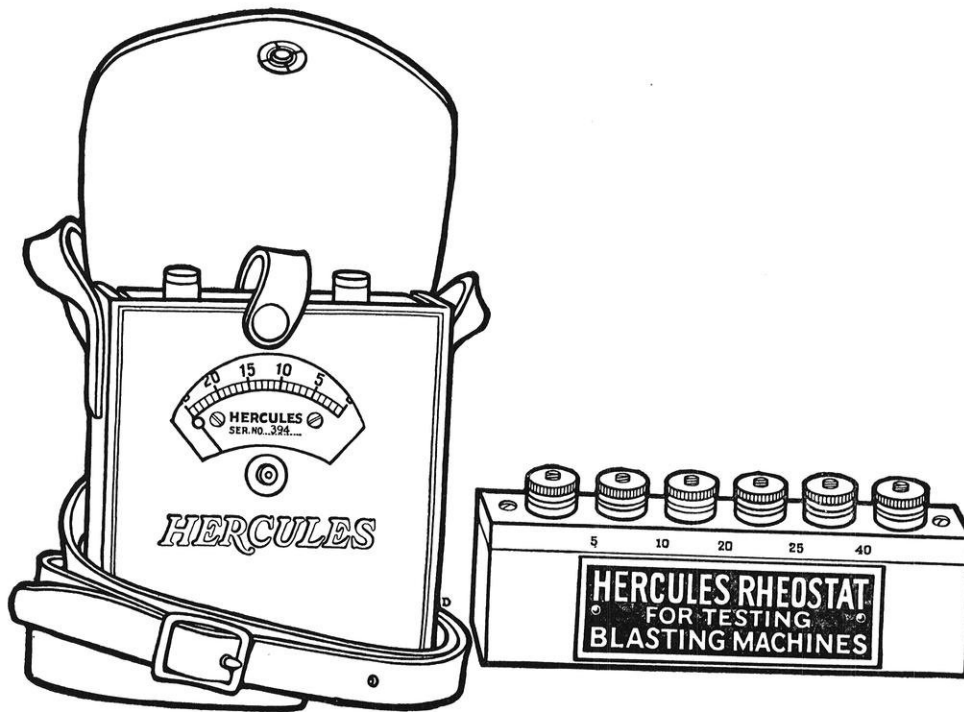
the relation that his particular business bears to the world of industry. It is needless to say that the college preparation a young man receives plays an important part in determining whether his tendency shall be one to become a technician or an engineer, whether he shall be lead or be a leader in his field of industry. Intensive adherence to purely technical subjects without a proper appreciation of their relative importance in our industrial order has a tendency to limit the vision of a man to the solution of the problems at hand. However, for industrial leadership, while the intensive training in the fundamentals of technology is essential, a knowledge of the elements of economics, accounting and finance is also necessary.

The expert technical knowledge tends to make a highly valued technician, but an engineer, for the intelligent handling of the increasingly complicated duties that he is called upon to perform, must also have a proper understanding of the human factors involved in management. For this the older humanitarian mould of thought is desirable, but a sympathetic appreciation of the fundamentals upon which rests our economic and social structure is absolutely indispensable.

A REVIEW OF THE 1924 SURVEY CAMP*(Concluded from page 30)*

is evidenced by the small sick list. Everyone seemed well all the time — though, perhaps, overworked. Bob Webb left camp several days because he didn't agree with poison ivy; and Reed, our versatile assistant chief engineer, didn't agree with his "Lizzie", who kicked and broke his wrist which didn't prevent George from going on with his field work and drafting. During the last few days of camp Piltz was unfortunately disabled with an infection in his leg. The rest of us, barring a few cases of "heart trouble," were quite healthy.

The camp was topped off with the traditional banquet. Everyone felt fine; smokes were passed around; and Plautz, as chief engineer and toastmaster, succeeded in getting the pros to tell us how good we were. We learned to our satisfaction that there had been worse bunches than ours — especially in the days of Mr. Stack. On our part we — as Coates put it in his final report — "absolved the faculty of all blame for working us so hard."



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WE take unusual precautions in the manufacture and testing of our electric blasting caps, often using an X-ray to check the adjustment of the minute platinum-iridium bridge and to detect any faults, the evidence of which would be destroyed in the usual method of testing caps by shooting them.

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Breaks, short circuits, or faulty connections can be easily detected and located with a Hercules galvanometer before an attempt is made to fire a shot. This helps to prevent misfires and saves both time and money.

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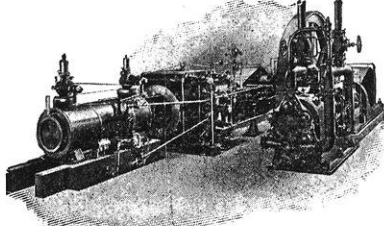


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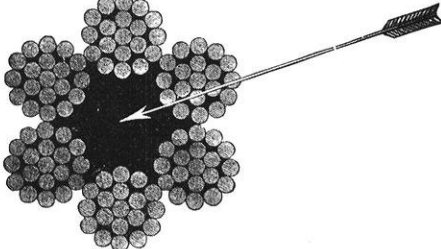
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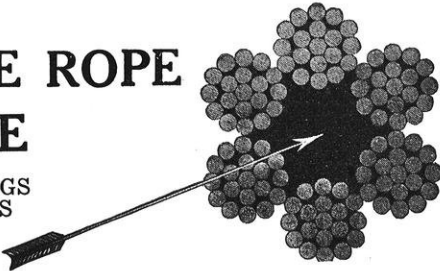
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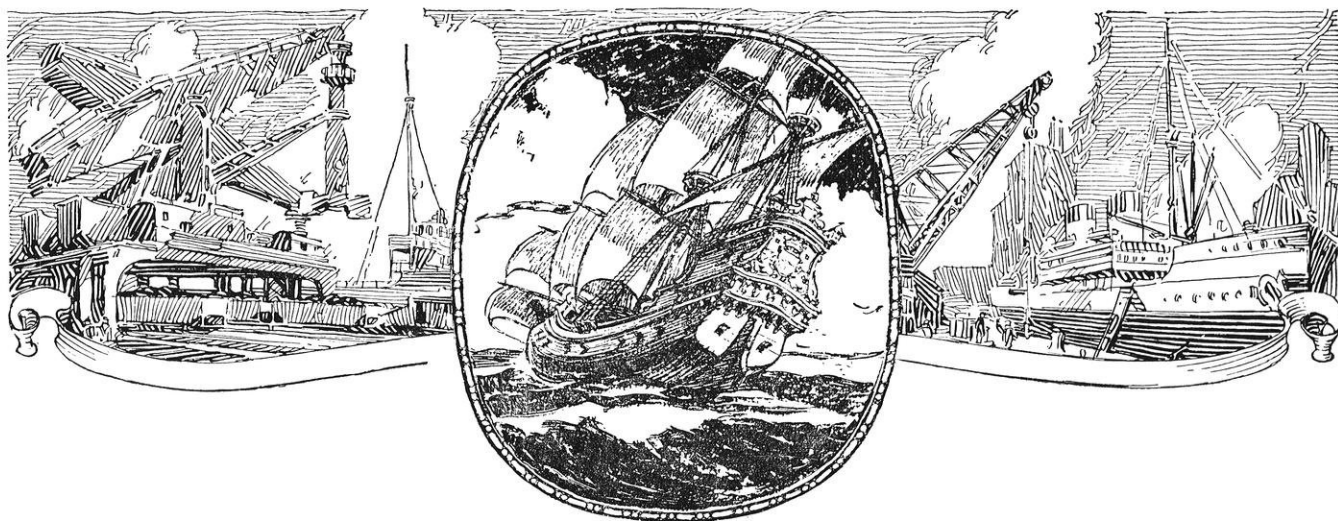
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Great honors came to him, yet he will be remembered not for what he received, but for what he gave. Humanity will share forever in the profit of his research. This is the reward of the scientist, this is enduring glory.



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