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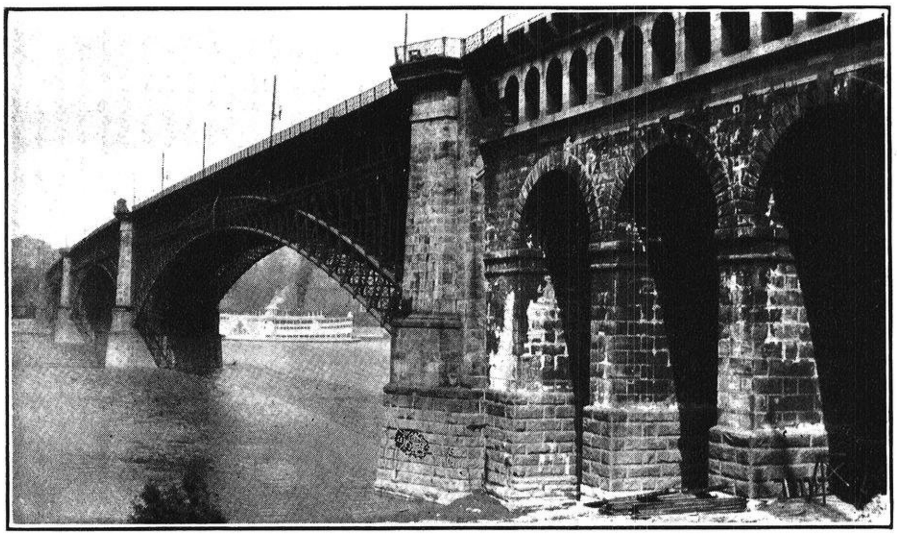

THE EADS BRIDGE

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CONTENTS

VOLUME 34 — DECEMBER, 1929 — NO. 3

The WISCONSIN ENGINEER

VOLUME 34, NO. 3 DECEMBER, 1929

A Great Engineering Achievement of the 1870's Is

The Eads Bridge

By Ralph C. McMullen, c'27

THE story of the erection of the Eads Bridge across the Mississippi River at St. Louis, is an account of a ten year's struggle by engineers to bridge this stream which is at times a boiling torrent laden with driftwood and ice.

The depth of water ranges from 10 feet at ordinary flow to 70 feet at flood stage. There is a rapid current here which varies in velocity from five to nine miles per hour, depending on the stage of the river. The sand bed of the river is about 80 feet in depth at low water, but it is only a few feet in depth at flood stage. The rock bed of the river is 13 feet below low water at the west shore and 93 feet at the east shore. The rise and fall of the river is about thirty-four feet.

One of the first construction difficulties encountered was sinking the west abutment cofferdam through 12 feet of deposit made up of city refuse, discarded steamboats and barges, and rock fill, in a depth of 17 feet of water. Another problem was sinking the two piers 500 feet from shore, and 500 feet apart. The engineers were without precedent to guide them in the use of the pneumatic caisson at the great depths encountered in the river piers and east abutment. The design of the bridge called for spans two-hundred feet greater than any that had ever been built; it required materials with properties exceeding those of the materials then used for structural members. The final problem was that of erecting the superstructure without blocking the river channel.

EDITOR'S NOTE

James B. Eads, born in 1820, was an outstanding example of the self-educated man. He received his theoretical technical knowledge in the library of a dry goods dealer who was his employer. The practical experiences which added to his general education were obtained when he worked on a river boat. His success was due to his self-confidence, and an almost inexhaustible enthusiastic energy. He died in 1887, after having received the supreme honor of the Albert medal which was presented to him in 1884.

The need for a bridge across the Mississippi river at St. Louis, developed in 1864, at the time railroads were building into the west. The inter-city traffic between East St. Louis and St. Louis made it important that adequate provision be made for vehicular traffic. A survey made in 1864 showed that 52,000 teams crossed the river on the ferries each year. In addition, 900,000 tons of coal were hauled by van. There were 12 railroads using the car ferries. It was estimated that the bridge would have an income of about a million dollars from these sources.

There were three favorable locations for a bridge. The railroads favored a location in the northern part of the city. The St. Louis and Illinois Bridge company chose a location at a site centrally located with respect to the city. The Illinois Bridge company chose a site between these two locations.

The site selected by the St. Louis and Illinois Bridge company was recommended by Capt. James B. Eads. This location was at the narrowest part of the river channel, and it divided the wharf front of the city equally. The Missouri end of the bridge was on a principal avenue of the city, with an equal distribution of population on either side of axis of the bridge. Topographical conditions were such that a union depot and freight center could be located near by, and connected with the bridge by tunnel. The depot location offered easy access to all the railroads. Thus the site insured the most convenient service to the general public since it was the best location for vehicular traffic, and was the best location for the majority of the railroads.

The St. Louis and Illinois Bridge company accepted Eads' plan of spanning the river with three steel arches, and prepared to carry out the work. At Ead's suggestion the plans of the bridge were submitted to J. H. Linville, bridge engineer of the Pennsylvania R. R., for his approval as consulting engineer. He reported: "I cannot consent to imperil my reputation by appearing to encourage or approve of its adoption. I deem it entirely unsafe and impracticable, as well as in fault in the qualities of durability."

The promoters had faith in Eads' ability as an engineer, and agreed that the bridge should be built in spite of Linville's report. In August, 1867, work started on the cofferdam of the west abutment of the bridge. The cofferdam was 112 feet long, 80 feet wide, and was carried to a depth of 30 feet of water. The site of the dam had been a steamboat wharf for 60 years. It developed during excavations that the site had been the dumping ground for old iron, grate bars, boilers, smokestacks, and city refuse. Two wrecks were encountered, one above the other, the planks of which were of three or four inch oak. Other foreign material encountered included sawlogs, chains, anchors, paddle wheels, crank shafts, and engines.

In the meantime the Illinois Bridge Company, backed by the disgruntled railroads, tried to stop the work of the St. Louis company. First they attempted to force the issue by court proceedings. In this move they were supported by the ferry boat companies, and river men. At the same time arrangements were made for a convention of prominent civil engineers to convene at St. Louis and review the various plans. The meeting was attended by 27 civil engineers.

The engineers decided against Eads' plan on the grounds that it would not be practicable to procure suitable materials of the form, size, and workmanship required in his design. The report was rendered at the time Eads was having his costly experience in sinking the west abutment cofferdam, which was to be the shallowest of all the piers and abutments. The excessive cost of this work on the shore abutment along with the report of the convention, created distrust in the minds of the investors and promoters. Financial support was withdrawn with the result that the work was suspended in the spring of 1868. The workings were abandoned and allowed to be flooded and filled with mud.

Eads was then called on to submit a report to show how he planned to carry on the work. His report completely satisfied the parties at interest, and more money was raised so that the work was resumed in May. The constant troubles and criticisms resulted in the failure of Eads' health. He dropped his work and took a trip to Europe. In April of the following year he returned, with renewed health and new ideas.

His original plans had called for the sinking of the river piers by open dredging in cofferdams. His European trip gave him an opportunity to witness the pneumatic caisson process. The conflicting companies, in the intervening time had merged their interests and were prepared to carry out Eads' plan.

On account of flood conditions, actual work on the river piers was delayed until August, 1869. Pile driving then started for the breakwater and icebreaker which was started in a depth of 47 feet of water. The piles were 70 feet long and were driven to a penetration of 15 feet. A rise of five feet covered the tops of the piles and delayed the work. It was difficult to place any form of construction above the pier that would not be quickly scoured out by the current, and also to make such construction strong enough to resist the power of the ice and driftwood.

Breakwater:

The breakwater was V-shaped with its apex 200 feet above the pier; it flared out to a width of 180 feet. The wings were about 200 feet long, and were formed by piles driven every eight feet. The enclosed area was filled in with piles every 14 feet, and the whole was braced at the top with 10x10 oak timbers. A cluster of nine piles was driven at a distance of 50 feet above the apex of the breakwater. These piles were encased with steel boiler plate for a depth of 12 feet. Beyond the cluster, a 42 inch boiler shell 28 feet long was sunk vertically in the bed of the river and was weighted with iron ore. The breakwater was protected by an inclined apron of oak plank.

Caissons:

The caissons were built at a near-by shipyard, and were floated to the site with false bottoms. Here they were placed between guide piles and fastened to the screws which were to adjust them during the descent into the water. Compressed air was forced into the air chamber, and the pressure created forced off the floating bottoms. The work of laying the masonry then started.

There was no precedent to guide the engineers in their work with compressed air in the excessive depths and pressures necessary in the piers. There were many cases of caisson disease. Costly experiments were tried in an effort to find the exact causes and the remedies. Men were placed in the air locks quickly, to determine if this had any bearing on the cause. Experiments were made on men coming out of the air locks to see if the sudden release from the pressure had any effect. The final conclusion of the medical staff was that the length of time in the air chamber was the cause of the disease, which is now known to be due to the presence in the blood stream of bubbles of nitrogen, which occurs when pressures are reduced too rapidly.

Masonry:

The masonry was laid in 18 to 30 inch courses. Magnesia limestone was used until a point was reached 2 feet below the low water mark. From this point to the high water mark, quarry-faced granite was used; above that point pointed-faced granite was laid. Work was carried on day and night. Candles were used for lighting the air chambers, and part of the time gasoline burners were used. The masonry work was illuminated by calcium lights and lamps.

Superstructure:

The superstructure was raised by means of a scaffold on the abutments, and a suspension system, using the inherent stiffness of the arch ribs as cantilevers. The arches were built up and extended over the river from each pier. This meant that the last tube must be inserted at the mid-point of the span. The arch curve and length were based on loading conditions, and hence when the time came to insert the closing tubes, there was not sufficient room. Both arches curved three inches to the north. One was over eight inches high and another was two inches from joining. Many expedients were tried in an effort to reduce the length of the ribs. Strains were placed on the suspension cables; ribs were jacked on ice. Finally adjustable tubes were resorted to, and were operated under varying conditions and temperature.

The bridge was opened for traffic on July 4, 1874. It has given satisfactory service for fifty-four years. A committee which was recently called upon to investigate its present condition reported as follows: "The conclusion of the committee is that the Eads bridge is today in excellent physical condition and amply safe for the loads and service it is called upon to carry and is carrying."

Before his death Eads was the leading authority on harbor and river improvements. His professional advice was used at St. Johns, Columbia, Toronto, Vera Cruz, Tampico, Vicksburg, Liverpool, and Galveston. He was a member of many societies in the United States and in Europe.

Eads' interest was almost entirely directed toward river projects. His early experience on the river gave him a foundation which was responsible for his later success.

During the Civil war he contracted to build armor plated gun-boats for the government, inside of sixty days. Timber was brought from eight different states; telegraph lines to Pittsburgh and Cincinnati were kept busy for hours. The iron was rolled in three states.

Later, in 1875, he came forward with an offer to solve the river problem at the gulf. The most important engineering work ever undertaken by the government was given over to Eads. He succeeded, however, in constructing an open channel to the gulf which was twenty-eight feet in depth. The contract compelled him to maintain this depth for twenty years. By means of his ingenious methods, he built the channel so that it would scour itself.

In 1879 the plans of the interoceanic canal, which were designed by De Lesseps, attracted Eads' interest. He fabricated a plan of his own, which, according to his calculations, was 2000 miles shorter than the Panama Canal route is now, and which was cheap, quickly built, safe and rapid, and easily maintained and increased. This plan was to transport even the largest ships across the isthmus of Tehuantepec by means of a large ship railway. The railway consisted of a large cradle mounted on 1,500 wheels which would run on a dozen parallel rails. Although the plan was endorsed by a number of leading engineers of that period, it was soon forgotten after his death.

"I BUILT A BRIDGE —"

I built a bridge,
Whose serried towers 'kist the wind-swept skies.
Span on span,
From shore to shore across the hissing tide.
I built a bridge,
With cable arcs cupping the skies vast blue.
Link on link,
Fading away like purple shadows dipped in far
horizons.
I built a bridge,
From earth to sky against the eternal sun.
Truss to truss,
Of deeds my whole life girdled round.
And when the time shall come,
When I must cross that bridge my soul has built,
God grant that it stand firm!
Symbolic of a race that's run, a pathway to the
stars.
No greater praise can men then confer:
"He built a bridge!"

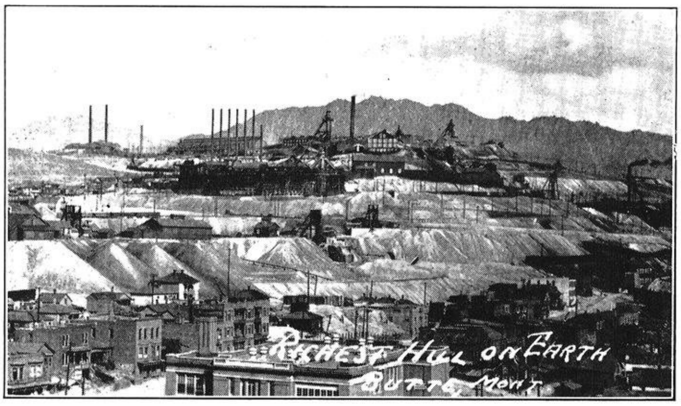
—*R. D. Jordan, '27*

Engineering and Big Business Make Mining Economically Sound

By O. C. SCHMEDEMAN, min'30

IN the winter months in a certain western mining camp the ranchers of the district leave their sheep in the folds and come to town to earn a few dollars at mining. The story goes that one winter day a sheepherder appeared at the shaft house fully equipped for work except for a miner's lamp. On questioning as to his lack of this device, which is as important to a miner as a transit to a surveyor, he naively explained that because he was to work on the day shift that a lamp would be useless.

The layman in general it seems, is apt to forget his lamp of wisdom when he looks at mining work, and generalizes in such terms as romance, riches, swindles, luck about any part of the industry, which today is second only to agriculture as a basic of our economic life. Since the turn of the century, mining has, with the help of such engineering genii as Hoover, Hammond, Janin Richards and others, been placed on a sound economical basis by the application of scientific planning and operation. Still the idea persists that mining is clothed in mystery and, with luck, fortunes may be easily acquired.



One of Our Country's Mining Centers.

New mining ventures are risky in just the same way as is any new business undertaking due to mismanagement, fluctuations in prices etc., but it must also overcome difficulties of a natural sort in the matter of determining the size, shape, and value of the orebody, getting rid of noxious gases, and securing transportation facilities to the isolated districts where mines are often located. To bring out and explain some of these natural problems in mining and how they have led to the prosperity of the present industry, the rest of this article is devoted.

Nature has scattered and hidden away its resources quite successfully and only here and there exposed a stained outcrop, a glittering bit of gold in a stream, or a shining diamond to indicate the presence of a nearby deposit of the mineral. Until the last of the 19th century the science of geology or the knowledge of the earth was inadequate to predict likely areas for the presence of mineral deposits or to determine their limits when found. So, before this time, discoveries and the working out of the vein was more or less haphazard, and subject to the rule of thumb predictions of the miner. A great deal of energy has been wasted in the prospecting of areas which, in the light of modern geological knowledge, would be easily determined as barren. Agricola, the faithful recorder of mining of the 16th century mentions that the miners of that day in Westphalia would prospect only on the south side of gently sloping hills, believing that the sun drew the mineral juices to such spots. Of course this greatly narrowed the search and also limited the chances of finding ore.

The modern geologist has found that certain rules of a little sounder nature than this are useful in narrowing the search for minerals. He has found that certain minerals occur in certain rocks, thus the metals and gems are nearly always in vein deposits as a result of igneous action; i. e. they have come from a magma which has worked its way up from the deeper regions in a fluid state and either flowed out on the surface or worked its way into fissures and fractures of the upper rocks. On the other hand, the coal oil and non-metallics have had a sedimentary origin and have been formed in beds on the floors of ancient seas. Unless the beds in which the minerals occur have been subject to earth movement and so bent and folded as to form mountains, then they will be today in the horizontal position in which they were formed.

Frequently the original deposits have been worn away by erosion and weathering so that only the more resistant minerals have survived; thus giving rise to placer deposits or alluvial. Gold, diamonds and tin are often found in sufficient quantities in such manner to be profitably mined. By means of huge dredges, placer gold gravels have been mined successfully for such small amounts as 20 cents per cubic yard. Placer deposits are indicative of an original vein bearing the mineral. In California and Alaska, important veins have been discovered by exploring the district adjacent to the streams or valleys in which the placers are located.

By rough mapping of large areas geologists can determine whether the area is of a sedimentary or igneous nature and from such information reason whether the metals or nonmetals may be present. If the area is sedimentary the form of the fossil life present in the rocks is indicative of the geologic age of the district. If that age is not of an age in which coal and oil were formed, then the district is quite unfavorable for extensive prospecting. Thus the southern half of Wisconsin and large areas in the Mississippi valley are covered by sediments of too old an age to contain coal and oil and are barren minerally except for the unusual deposits of lead and zinc. It has been repeatedly claimed by some that oil is present in the state in an area which is entirely destitute of any carbonaceous matter in the rocks. Such a claim is utterly without the support of reason and should be discouraged as such.

Preparing a Blast in a Mine at Butte, Montana.

Sedimentary areas such as the Ohio River valley are quite favorable for the presence of coal and any claims of such emanating from this district are well within reason. A large part of Texas and Oklahoma are covered by sediments which are known to be favorable for oil, so an extensive search is being carried out for domes and pools.

If on the other hand the area is found to be igneous, or in part igneous, the search is made more difficult than in a sedimentary area for no ready rules apply which justify eliminating any part of the district from consideration as having no mineral value. Thus most any part of the Rocky Mountain district may contain valuable minerals and the location of such minerals must be carried on in the field by intensive search, with the help of such variable rules which locally apply.

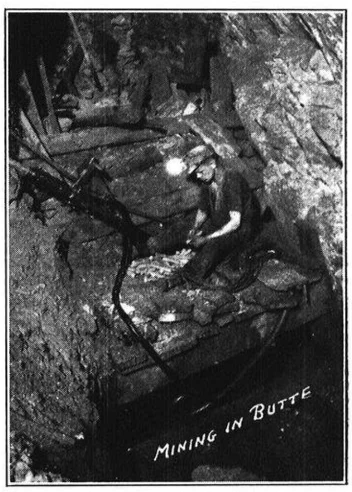
The marking out of the horizontal and vertical extent of a vein is the most important job of the geologist, for upon such information the value of the property is calculated and capital invested accordingly. To reasonably know the amount and value of the ore is to predict the life and success of the undertaking and, upon the best determination of this value, rests, in large part, the elimination of nature's hindrance to the economic development of the mine. It is because of the lack of such information that many mines have failed so miserably. It is so easy to predict from an easy chair that such and such a vein will continue far enough to justify its exploitation, but it is also easy to find many cases where rich veins have stopped abruptly and terminated the life of the mine. Hoover when engaged in mining work found, by use of an extensive questionaire, that it was a rare mine that payed dividends after 500 feet in depth had been reached. Even the best of geological work fails to predict and determine with mathematical fineness, but it does avoid a good deal of dangers inherent in mining undertakings, and is absolutely essential before sound production should begin.

Lately the geophysicist, with the aid of torsion balances, delicate magnets, siesmographs and inductive circuits has greatly increased the range of physical observation and has been of considerable help in checking predictions made from surface indications. Most use of these methods is in the oil fields in the finding of domes, but some success has been met in delimiting bedded rocks.

As a result the production of minerals is complex and often exceedingly difficult, being carried on for the most part in the half light of carbide lamps in closely confined and rough quarters. Danger and failure of the enterprise results when incompetent men endeavor to mine with poor equipment and antique methods. Here again the modern engineer, by perfecting blasting powders, planning ventilating equipment, putting in mechanical drills and loaders and other such devices along with scientific planning, has reduced the hazards of mining.

After the ore is brought to the surface it must be crushed, sorted, smelted and refined; all difficulties which must be met before success is attained. Here again metallurgical engineers have developed and installed processes and equipment which is available to those who can afford and are willing to pay for sound methods.

Today the business of mining is carried on for the most part by large companies which operate many mines in districts where before each mine was run by a separate company. Thus we have such huge companies as Anaconda Copper, U. S. Steel, Shell and Standard oils, Miami coal, etc., who have the advantage of large capital resources and can make an otherwise unprofitable mine pay by virtue of the advantages in the way of hiring the best technical and business talent to plan and direct the work on a scientific and economic basis. The entrepreneur has a difficult task today to make his mine pay and it is only with the best of luck and ability that such undertakings are successful. Only in gold mining where price is certain and amount of ore sometimes large enough to pay highly has the small company a real chance. The investor in small gold mines will do well to ascertain the integrity and ability of the management before investing and not investing in one but in ten ventures so as to make surer by the laws of chance of realizing a profit from his undertakings.



Drilling in a Mine Near Butte, Montana.

The United States with its large natural resources and big business methods produces over one-third of the world's mineral wealth, the value of which last year was over twelve billion dollars. It is essential for the continued prosperity of our country that the development and utilization of these natural resources be so continued on a sound economic basis.

A Description of the Scientific Use of Artificial Methods Used in

Restoring Speech

By R. R. Riesz, '25

IN the United States there are several hundred people who, because of malignant disease, have had their larynx or "voice-box" removed by a surgical operation. After removal of the larynx, breathing no longer takes place through the nose: the windpipe is terminated directly in an opening in the front of the neck. The effects of this operation on the ability to speak, and the problem of minimizing them, can best be discussed by first surveying the nature of speech sounds and their normal production.

	Voiced Sounds		
Vowels	oo as in pool		a as in tap
	u as in put		e as in ten
	o as in tone		a as in tape
	au as in talk		i as in tip
	o as in ton		e as in team
	ä as in father		
Semi-Vowels	l		
	r	Dipthongs	i as in high
	m		ou as in house
	n		oi as in boy
	ng		ew as in mute
Transitionals	w as in win		
	y as in yes		
			Unvoiced Sounds
Fricative Consonants	v		f
	z		s
	th as in then		th as in thin
	zh		sh
Stop Consonants	b		p
	d		t
	j		ch
	g		k
Aspirant			h

TABLE I — *Common English speech sounds.*

EDITOR'S NOTE

R. R. Riesz entered Ripon College in 1920, after two years with the Engineering Department of the Western Electric Company. Receiving the A. B. degree in 1924, he spent a year at the University of Wisconsin as an assistant in physics, receiving the M. A. degree. Since 1925 he has been with the Research Department of Bell Telephone Laboratories studying the mechanics of vibrating systems.

The sounds composing our spoken language may be classified in a number of ways depending on the point of view; for the present purpose it is convenient to divide speech sounds into two groups (Table I). In the first group are placed all the "voiced" sounds, in the production of which the generation of sound by the vocal cords plays an important part. Vowels, semi-vowels, diphthongs, transitionals and voiced consonants are members of this group. The second group comprises the "unvoiced" sounds, in the production of which no sound is generated by the vocal cords. In the group are placed the unvoiced consonants.

With a single exception all the unvoiced sounds are produced in the mouth. In producing the fricative consonants a current of air is blown through a narrow slit formed between the tongue and the roof of the mouth, between the teeth and the tongue, between the teeth, or between the teeth and the lower lip. In producing the stop consonants the current of air is suddenly started or stopped by any of the above combinations. The aspirant sound, h, is a particular way of beginning a vowel or diphthong by blowing a current of air with the mouth passage fairly wide open.

For the voiced sounds, on the other hand, the source of sound is no longer located in the mouth but in the larynx or voice-box. The larynx is situated in the throat and is connected with the lungs, and contains a pair of bellows consisting of many small air sacs. In the larynx is a pair of exceedinly adjustable lips, the vocal cords, which during ordinary breathing are drawn out of the way allowing air to pass freely to and from the lungs. When a speaker desires to produce a sound, these remarkable vocal cords are drawn close together to leave a narrow slit between them. Then, as the lungs force a current of air through this slit, the vocal cords are thrown into vibration and change the steady current of air from the lungs into a pulsating sound wave. The action of the vocal cords is not unlike that of the lips of a trumpeter, when they are placed under tension against the mouthpiece and a stream of air is blown through the narrow slit formed between them.

The sound produced by the vocal cords would probably never be recognized as a vowel by a listener, if it were possible for him to hear it directly. It corresponds to the rough block of marble out of which the sculptor carves his statue. This basic sound passes from the larynx up into the cavities of the throat, mouth and nose where its quality is modified by the resonating action of these cavities. Thus modified, it is finally radiated into the air as a recognizable speech sound.

The removal of the larynx, therefore, destroys the power of speech, because it prevents the admission of the air stream to the mouth and because it removes the vibratory vocal cords. The power can be restored by providing a new passage for the air stream from lungs to mouth and interposing a vibratory element in it. Apparatus which fills these functions has been developed and is available under the name, "artificial larynx." Stated thus in scientific

(Continued on page 120)

How the Old Wisconsin Lumberjack Applied His Scientific Impulses

Paul Bunyan---The Surveyor Extraordinary

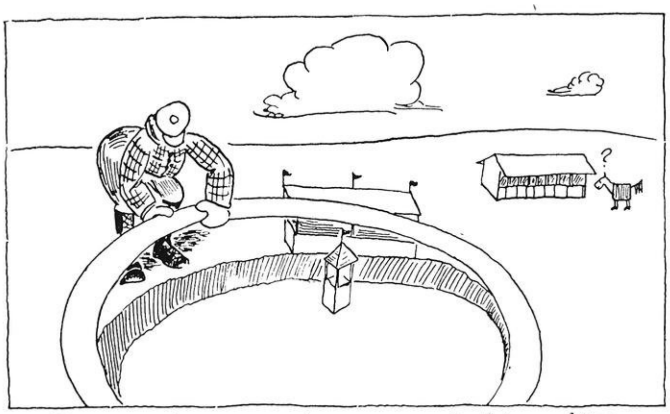
By RAY S. OWEN, c'04
Professor of Topographical Engineering

IN reading over the literature recently published regarding the renowned early Wisconsin character, Paul Bunyan, it was the occasion of considerable surprise to find that nothing was mentioned of Paul's famous exploits as a land surveyor.

The old lumber companies had to hire surveyors to survey and compute areas of timber land, fractional sections and townships, but the process was slow and expensive, entailing as it did the clearing of lines and measurement of bearings and distances, as well as laborious computation by a hot fire in the evenings, after a day's survey in the cold, with the attendant drowsiness and errors.

The work dragged so that Paul was appealed to for aid. He had had some experience in engineering office work and bethought himself of the planimeter. His plan was to planimeter the land directly, but he was not able to find a planimeter on the market large enough for his purpose, so he concluded to build one. He had some trouble in finding a suitable wheel but finally procured a quarter-mile race track in fair condition, round, with a good outside edge. He then got a couple of pieces of the state line between Wisconsin and Michigan, one of these was 10 miles long and the other about 8. He put the race track up on edge and attached it to the end of the longer piece of state line, using as bearings, balls from the Cannon Ball River.

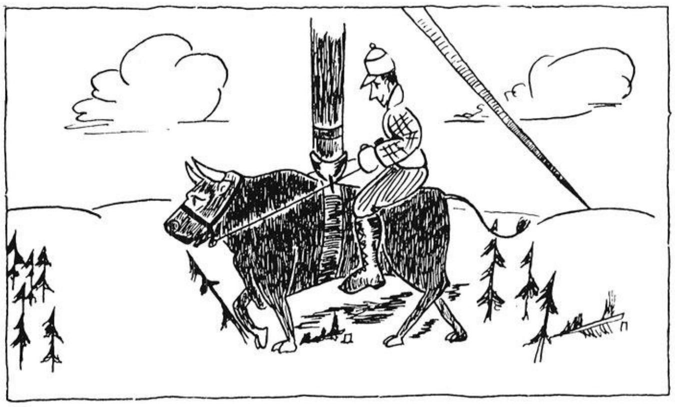
For the tracing point he found a 200-foot pine, and fastened it to the 10-mile arm, with the smaller end down.



He procured a quarter-mile race track in fair condition, round, with a good outside edge.

Another similar tree was used for the fixed point at the end of the shorter 8-mile arm. The joint where the short arm joined the long arm, was improvised with the steel axle of an overshot water wheel, 25 feet long and 8 inches in diameter, as the pin.

The perimeter of the wheel was graduated into 100 parts, by marking the roadway with strips of white pancake batter, 1 foot wide. This took 10 barrels of wheat flour, and each lumber jack in camp had one pancake less for



With the tracing point in the socket on the horn of the saddle, he mounted his blue ox and rode carefully around the boundaries of the land.

breakfast the next morning, after which a new supply of flour was obtained.

He selected Section 37 of Town 41 North, Range 10 East, to use in calibrating the planimeter. He soon had the length of arm adjusted to read acres direct. He then rigged up a saddle for the blue ox with a socket attached to the saddle horn and into this was set the tracing point.

The method used was to set up the instrument within a few miles of the area to be surveyed, then with the tracing point in the socket on the horn of the saddle, he would mount the blue ox and ride carefully around the boundaries of the land.

The arms cleared the tops of trees and hills and he was able to proceed at the rate of about 2½ miles an hour, thus with the necessary setups and readings he was able to obtain the area of a section of land to 1/100 of an acre in about 2 hours. A township would take him a full day.

He surveyed all the townships of Price County in just five weeks. It was with the aid of this instrument that Paul was able to calculate the length of the Round River. He had some difficulty in lubricating the joint at the junction of the two arms, but it was solved for a time by butchering a fat hog, and attaching the carcass to the top of the 8 inch iron pin. The combination of the frictional heat and sun's rays then melted the lard which ran down the pin and supplied lubrication as needed.

Paul used this machine successfully for many years.

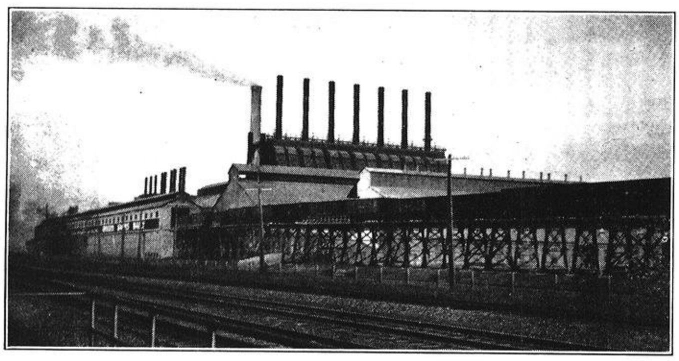
(Continued on page 110)

The Electrical and Mechanical Engineering Inspection Trip

By E. A. CHRISTIAN, e'30

FINAL instructions had been given; advice prompted by years of experience was imparted; the field was in readiness, and the men were eager to enter upon their conquest. This was the state of affairs that existed prior to the opening date of the annual electrical and mechanical senior engineering inspection trip. Professor James "Jimmie" Watson, assisted by Professor Patrick H. "Pat" Hyland, Professor L. E. A. Kelso, and Professor L. A. Wilson arranged for the trip and for the two enjoyable guest meals.

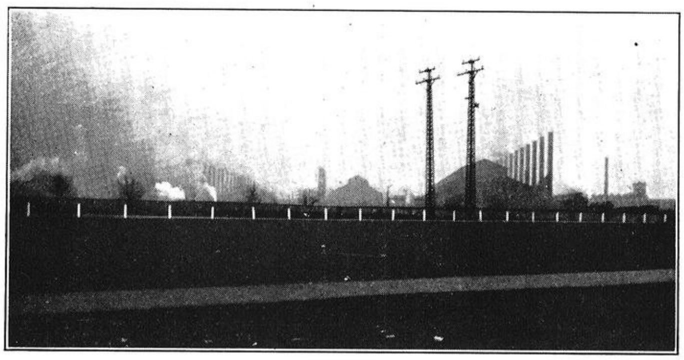
In compliance with the first item of the instruction sheet, the entire party met at 8 the morning of November 4, 1929, in front of the Public Service Building of the T. M. E. R. & L. company. From this point the student inspectors proceeded to the Allis-Chalmers plant in West Allis, a suburb of Milwaukee, Wisconsin. Groups of ten or fifteen under separate guides were conducted through the plant in which are manufactured transformers, horizontal and vertical switch control apparatus, dynamos, and trailors. Twelve-thirty noon found all the groups congregated at the Allis club ready to ravenously partake of the food set before them with the compliments of the Allis-Chalmers company. As the groups entered the dining room someone was heard to call for a Murad for J. A. Johnson in the morning's rush had forgotten to wear his vest and suit coat. Since no one could produce a Murad the situation took on serious proportions and J. A. began to sympathize with Adam. At the end of the meal Guth and his "gang" harmonized "St. Patrick Was an Engineer" but neglected to finish the third verse because an outburst of hilarious



The Cement Plant at Buffington.

laughter greeted the phrase "For he invented the steam and gas".

All good things have an end; so, with the last course of the guest luncheon the mechanicals and electricals parted ways, the mechanicals to the Falk company and the Phoenix Hosiery company (they would) and the electricals to the Milwaukee branch of the Westinghouse Lamp Works. Production in the lamp works often runs 125,000 lamps per day, the lamps varying in size, wattage, shape, coloring, and process of construction. Ingenious devices, seemingly human, handled the bulbs; sealed and soldered the leads; administered the correct amount of coloring matter inside and outside the bulb; inserted glass tube stiffeners and leads; kept the bulbs and its component parts dry through all the operations; and finally tested the completed lamp for correct brillancy. Most of the operatives of the plant were women who were required to keep their eyes on their work all of the time, but some of the group noticed the hard time experienced by a great many of them with such magnetic personalities as Tiegs, Canfield, and Bolliger sauntering in their vicinity. When Tiegs, Bolliger, and Canfield were finally able to break away from the plant, the groups adjourned to the car line to wait for the free transportation supplied by the T. M. E. R. & L. company. Shows, dates, and other ("Gayety") activities climaxed the first day's trampings.



The Steel Mill at Gary.

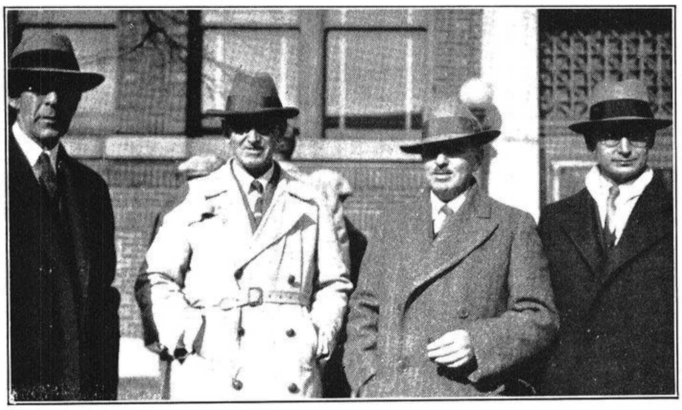
On the morrow of the next day, the weary inspectors were aroused bright and early and chaperoned to the A. O. Smith corporation. While waiting in front of the offices for the Professors (five minutes was the limit) some of the group made known determinations to get the most out of the day's work in spite of the hardship. Some even produced notebooks, but Guth caused a wild commotion and a rush for standing room when he discovered the ideal mate in the office proper and then proceeded to pass the word around. When the uproar, which almost proved the undoing of this portion of the trip, was quieted the group was again divided and the student inspectors proceeded into the Smith plant which is noted for the mechanical automatic production of automobile frames, manufacturing

(Continued on page 104)

The Senior Trip Was Not All Engineering Inspection

By S. L. JOHNSTON, e'30

EVERYBODY got up bright and early Monday morning for an eight o'clock at the T. M. E. R. & L. Co. When everyone had arrived, we piled in a special car and rode to the Allis-Chalmers Company. There we tramped through smoke and fumes for three hours, covered acres and acres of plants, and worked up a powerful appetite for the free meal we were due for. We discovered that Allis-Chalmers turns out some wonderfully big machines. The trip through their tractor plant was especially interesting, as all of the machines were automatic.



The Inspection Trip Faculty.

We had dinner at the Allis Club, and to top it off the Triangle boys sang "St. Patrick Was an Engineer", but they stopped in the middle of the third verse when they got to the Steam and Gas chorus.

In the afternoon we visited the Westinghouse Lamp Works and saw how all of the lamps are made. Thus ended the first day and we went back to the Medford Hotel to ease our crop of young blisters that we had developed at Allis-Chalmers.

The next morning we went to the A. O. Smith Corporation. Two of the gang almost failed to show up, due to lack of sleep and other causes — ask Eddie Howes about it. The A. O. Smith plant is all synchronized and about all there is to do is to put the steel in at one end and pull the automobile frames out at the other.

From there we went to the Allen Bradley Company and saw how carbon pile rheostats were made. In the afternoon we toured the Lakeside Power Plant, and discovered how really dirty a powdered coal plant can be. We walked up the coal chute and into cubby holes that were so hot everyone had the idea they were at last in that well known place.

Wednesday morning we had to catch the train for Chicago, and by the time everyone was awake, we had to get off again to visit the Nordberg Manufacturing Plant. Quite a few of the gang had missed breakfast, so Pete's place (next door to Nordberg's) had a sell out on Near Beer and Cheese on Ryes. After we spent an hour freezing on the station platform the train came and we started for Kenosha to see the American Brass Company and Nash Motors. We had a lot of fun with the office girls at the American Brass, but the triumverate, Seielstad, Schaeffer, and Jauch, had to spoil it all by arriving in a taxi. On the way through the plant the guide showed us a pile of metal as big as a house and told us it was silver. Everyone was for carrying away a chunk.

It took quite a while to get to the Nash Plant, because Larry Morrison bought a Peppy Stories Magazine, and we stopped in front of the Fire Department to look at the pictures. At the Nash plant Landa was in his glory and almost talked an arm off the guide. We would have still been in Kenosha if the gang hadn't surrounded the guide and kept him away from Landa. As it was, we got to the station before the train arrived and watched the new Nashes fall to pieces on the testing track. Finally the train came, and on the way to Chicago Pete Bolliger learned how to play Hearts.

The next morning we all boarded the train for Buffington to see the Universal Portland Cement Company. They gave us coats and hats to absorb the dust, but they should have included gas masks, because the air was so full of dust that we couldn't see much. Our next stop was a joner — the Gary plant of the Illinois Steel Company. The plant covers fourteen hundred acres, and we walked all over it. All we could see was a lot of big machinery and hot metal. However, at least one engineer is glad that he made the trip to Gary, because the Burlesque show is missing one of its prize photos.

Bring on your Cement Plant.

Friday morning we went to Cicero to see the Hawthorne works of the Western Electric Company, and listened to Tyler tell about how he used to eat breakfast with Scarface Al Capone. After showing us where all of the telephone equipment comes from, the company treated us to a big meal. The Commonwealth Edison Company sent two busses to take us to the Crawford Avenue Power Plant. On the way back Freddie Tieggs discovered that you could ride nineteen miles on a street car for seven cents.

(Continued on page 118)

Editorials

PRACTICAL IDEALISM

A STUDENT from Germany who is taking work in Sociology at the University is quoted as saying that immigration from continental Europe is sociologically detrimental to this country until the third generation. The reason he gives is that the continental European is not trained to contribute to the community good. He expects to receive not to give, while the American is educated to place the welfare of the community first. The American expects to pay his share of the cost in taxes yet he goes to the town meeting and votes for the road which will serve the greatest number in his community rather than refusing to vote for the project unless it goes past his farm.

Whether or not this German student is correct in his estimate of the immigrant we believe he has pointed out one of the fundamental characteristics of our American civilization. President Hoover and the group of men with which he has surrounded himself is a striking illustration. Practically all of his appointees to the Cabinet and to administrative boards and commissions are men who have left highly paid private administrative positions to serve the nation at a smaller salary.

And Hoover is not an isolated example of the engineer serving his country. Not only are many of our profession serving the public in governmental positions, but most of the engineers in private practice find one of their most durable satisfaction in the service they render to the community. The men who build a great irrigation dam providing new homes for thousands; the men who have reduced the cost of the automobile until every family can own one; those who are annihilating space with the telephone, the radio and the airplane; and the hosts of engineers in other fields who are helping to make life more enjoyable for the multitude are entitled to the thrill which goes with a service rendered to the community. So long as this will to service is a prominent characteristic of our people we need have no fears for the safety of Democracy.

THE BASIS OF CREDIT

HOW the late J. P. Morgan answered certain questions concerning credit, collateral and character, when he was being officially quizzed about his $25,000,000 panic-checking loan and other matters, is intensely interesting at this time, when we hear so much as to those to whom loans should, or should not be made.

Samuel Untermyer: Is not credit based upon money?

J. P. Morgan: No, sir.

Mr. Untermyer: None whatever?

Mr. Morgan: No, sir, none whatever. I know lots of men who can borrow any amount, whose credit is unquestionable.

Mr. Untermyer: Is that not because it is believed that they have the money back of them.

Mr. Morgan: No, sir, it is because people believe in the man.

Mr. Untermyer: And he might not be worth anything else?

Mr. Morgan: He might not have anything. I have known a man to come into my office, and I have given him a check for a million dollars, when I knew he had not a cent.

Mr. Untermyer: There are a good many of them?

Mr. Morgan: Yes, a good many.

Mr. Untermyer: Commercial credits are based on possession of money or property?

Mr. Morgan: Money or property or character.

Mr. Untermyer: Is not commercial credit based primarily upon money or property.

Mr. Morgan: No, sir, character.

Mr. Untermyer: Before money or property?

Mr. Morgan: Before money or anything else. Money cannot buy it.

OWNERSHIP OF UTILITIES

DUE to the progressive press and the political platform on the question of ownership of utility enterprises, the public has been aroused to feel that it is being exploited instead of served fairly by these huge producers of power in private control.

It is only natural that one who is unable to completely understand utility management will be swayed by the propaganda offered by politicians who are taking advantage of the average American's gullibility and ignorance on this vital subject. The unjust and numerous attacks on the privately owned public-serving utilities are many. One of their outstanding examples of bulldozing is to compare the provincially owned power plant of Ontario operating at Niagara Falls with low rates, with the private companies in Wisconsin which are operating dams with small heads and consequently charging higher rates. Any engineer can see the impossibility of such a comparison.

Perhaps the utilities do make larger profits than other types of business, but certainly in the face of competition and state restriction, they are not fleecing the public as many are apt to believe. Surely the case should be one of facts and regard for variables; not one of rash comparisons and silly sentimentalism.

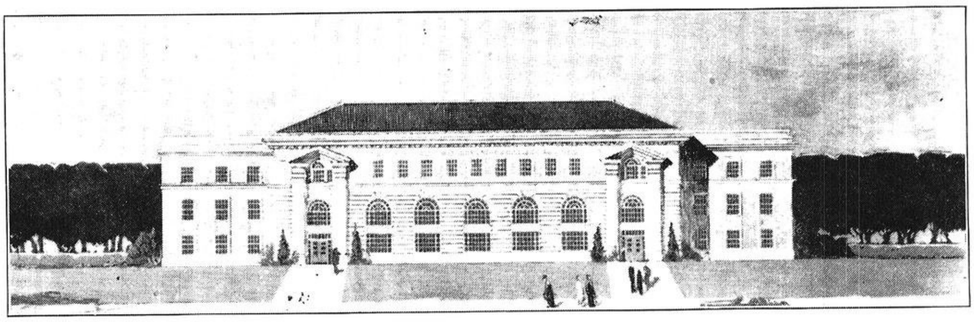
AN APOLOGY

The author of the article, *The Therapeutics of Railway Equipment,* in the November, 1929, issue of the *Wisconsin Engineer* was given as Fred S. Dean. His name is John S. Dean.

To The Mechanical Engineering Building, Good Bye

AND to the governor of our state, the man who killed the project, we put the wondering query, "Why?"

Why; after the state legislature, in 1927, approved the expenditure necessary to construct the building; after plans had been completed to relieve the College of Engineering of its present congested condition, which makes instruction difficult and laboratory work inefficient; after Dean Turneaure and the mechanical engineering department had made plans for the acquiring of modern equipment and adequate instruction facilities; why, we ask, does the governor withhold his signature from the contract?



IN MEMORIAM

THE PROPOSED MECHANICAL ENGINEERING BUILDING

Suppose we undertake to answer that question. We put ourselves in Governor Kohler's place. We are the governor. Before us is the contract for the new building. Politicians in the Capitol are clamoring for more office room. The administration's opposition is eagerly awaiting the opportunity to take the governor "for a political ride". Throughout the state, humane societies and women's clubs are demanding a new state home for crippled children. That, in brief, is the situation.

We are the governor. There is not enough money available to finance all three projects. It is for us to choose the two to be carried out to completion. Two of these projects, the home for crippled children and the state capitol annex, are backed by organizations of potential political power. The third project, the new mechanical engineering building, is backed by the University and its really interested friends in the state. The university as a potential political power, is regarded by state politicians as practically negligible. University faculty and loyal friends do not dabble in politics, and therefore do not exert much political force. Further than that, the authorities have deprived some ten thousand university students of their inherent right to the ballot.

We are the governor. Our political future is hung in the balance against our decision. The decision as a personal, practical advantage to the governor is obvious; cater to the political power in the state and forget the ultimate value and necessity for the new engineering building as against the ultimate value and necessity for the other projects.

So the governor, with a keen political foresight, forgot to sign the contract which would realize our dream in terms of stone and steel. And all the efforts of Dean Turneaure, Professor Larson, and the entire mechanical engineering department to house the testing laboratory and to provide room for the great work of the college, have gone for naught, due to the forgetfulness of the governor, an avowed "friend of the University". Of course he is a friend of the university; he admits it himself. So saying, he "about faces" and kills this absolutely essential university project which is necessary for the continued success and progress of our engineering college.

The whole situation seems rather pathetic to us. The administrator of the College of Engineering is Dean Frederick E. Turneaure, a man who stands head and shoulders, in a scientifically intellectual way, above others in his field. Under the administration of Dean Turneaure, our college has grown and improved until now it stands with the leaders in the country. All of this progress was made under the most trying conditions. The squabbling with an uninformed legislature in an attempt to convince them that money was really needed for improvements to insure future progress, the process of trying to employ a faculty of high caliber on the insufficient faculty salaries which the university pays, the inception of important research studies which have contributed immeasurably to the industrial and scientific progress of our state; all are features of the struggle of our dean and past deans to make the College of Engineering a leader among engineering schools. And now, after all these years of struggling, the further efforts of the administration, if not entirely blocked, are effectually hindered by a politically minded governor, — the "friend of the University".

In spite of all these obstacles to further progress, the engineering school will carry on. And now, Oscar, let's move the Diesel engine in behind the Nordberg so we can set up the new straight eight and get started on our test.

Alumni Notes

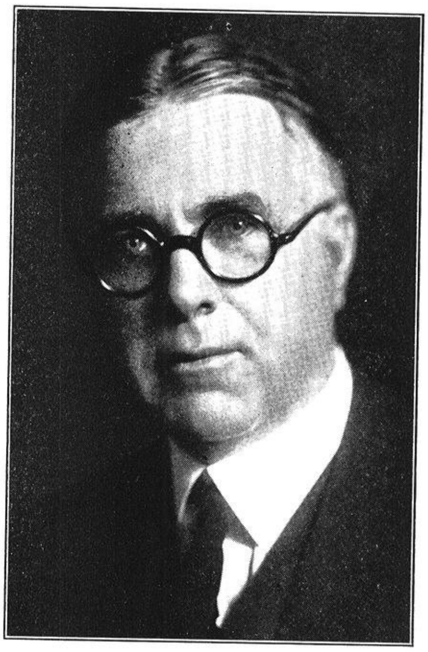
Successful Wisconsin Engineers
Henry A. Lardner

By Robert L. Van Hagan, c'32

An American engineer sailed from New York at the end of November on a voyage to Africa where he is to act as engineering adviser to Tafari Makonnen, King of Ethiopia, better known as Abyssinia. This famous African kingdom, whose royal family traces its descent from King Solomon and the Queen of Sheba, is ambitious to develop its resources and plans to build highways and power plants. Like many other foreign nations it has turned to America for a man to plan and supervise the development. The man upon whom falls the honor and responsibility is Henry Ackley Lardner, Wisconsin '93.

Henry Lardner is a Wisconsin product, born in Oconomowoc, October 1, 1871. He enrolled in the electrical engineering course at Wisconsin when he was eighteen and took work under Professor D. C. Jackson who was then head of the electrical engineering department and under Professor Storm Bull, who headed the engineering faculty at that time and taught mechanical engineering. Lardner became a member of Sigma Chi fraternity and lived at the house, which was then at 210 Langdon St. His chief interest outside of his engineering studies was in military matters and he was captain of one of the companies in the university battalion in his senior year.

Soon after his graduation, Mr. Lardner entered the employ of the J. G. White Engineering Corporation with which he has since been connected except for a period of three years, from '95 to '97, which he spent as instructor at Pennsylvania State College. He served the company in various capacities on engineering, construction, and operating work. He was made manager of the Pacific District office in 1908 and held the position for eight years. In 1912 he became vice-president and director of the corporation. His headquarters are now in New York City. He is also director of J. G. White & Co. of London.



Henry A. Lardner

Early in 1929, Mr. Lardner visited Abyssinia for his company, at the invitation of the king, to discuss the construction of roads in the empire and control works at Lake Tsana for the waters of the Blue Nile and the utilization of these waters in the Sudan by the British Sudan government. He is now returning to Abyssinia in regard to the same project.

Mr. Lardner is one prophet who is honored in his own community in spite of the rule to the contrary. His fellow citizens in the Town of Montclair, New Jersey, recognizing that his business and engineering experiences fitted for public office, elected him mayor, in which capacity he served from 1924 to 1928. His administration was highly satisfactory, an outstanding achievement being the securing of the right for Montclair to take five million gallons of water a day from the Wanaque reservoir of the City of Newark. He is at present a member of the Board of Education of Montclair.

Professional societies have commanded their share of Mr. Lardner's attention. He is past-president of the New York Electrical Society, trustee of the United Engineering Societies, and member of the Engineering Societies library board. He is also a member of the Engineers Club, the Lawyers Club, and the S. A. R. He rates "Who's Who in America."

Out-of-door recreations afford Mr. Lardner relaxation. He is fond of horseback riding and sailing. At his summer home at Point O'Woods, Long Island, he is director of the Point O'Woods Association and has been commodore of the yacht club on the Great South Bay.

Mr. Lardner was married to Ethel Anna Elmore of New York City on September 17, 1902. There are two children, Dorothy Ann and Richard Penn.

John Anderson

ON October 14th of this year the College of Engineering of the University of Wisconsin lost one of best and most loyal friends, Mr. John Anderson of Milwaukee, Wisconsin.

Mr. Anderson was born in Aberdeen, Scotland, on November 28, 1872. He started his career in 1885 as an apprentice engine builder and followed later with a course in the British Government School of Science and Technology at Liverpool. In 1890 he shipped on board a north Atlantic liner where he remained until 1898 when he joined the United States navy as a junior assistant engineer. By 1906 John Anderson had become chief engineer on the largest and swiftest vessel of the United States navy, the "St. Paul". From that date on he left marine engineering and became associated with stationary engineering. His first work in stationary engineering was in the capacity of superintendent of heating of the Union Electric Light & Power Company at St. Louis, Missouri. In 1912 Mr. Anderson left St. Louis and became associated with The Milwaukee Electric Railway & Light Company at Milwaukee as chief engineer, and he remained in the employ of this company until the time of his death, although in 1915 he became Vice-President in charge of power.


JOHN ANDERSON

Mr. Anderson ranked among the foremost mechanical engineers in our country and his reputation had become internationally established. A pioneer in the application of pulverized fuel to stationary boilers he struggled for many years to overcome the difficulties which had caused other engineers to conclude that it could not be done, until in 1920 he was directly responsible for not only the world's first large pulverized fuel station, but one that became the most efficient central station in the world. The Lakeside power plant, later destined to become the world's pulverized fuel laboratory, stands as a memorial to John Anderson. It was here also that he was largely responsible for the development of radiant superheaters and the installation of some of the largest of the first high pressure boiler installations.

Busy as he was in industry, John Anderson always found time to assist and help outside of industry. During the world war in addition to his regular duties he assumed the responsibilities of consulting engineer for overseas transportation. He served the City of Milwaukee on two of its most important commissions, the sewage commission and the safety commission. Mr. Anderson was associated with the Boy Scout movement, was one of the most active supporters of the American Legion at Milwaukee, and he always found time to work with and help fellow employees within his own company through the Employees Mutual Benefit Association. John Anderson was a friend of the University, and engineers among the alumni will always remember him in a friendly spirit for the time and help he gave when they visited plants he had built and operated.

Unfortunately his life was cut short at the age of fifty-seven, but it must be said that if all men at that age could look back to the record of accomplishment of Mr. Anderson, their lives would have been well spent. It is for us to carry on where he left off, and his work should serve as an inspiration to all young engineers and especially those from the University of Wisconsin, with whom he was closely associated.

CHEMICALS

Clark, Manley H., ch'22, was married to Miss Virginia Coleman of Wenatchee, Washington, on the eleventh of September. The couple will make their home in Pasadena, California, where Mr. Clark is sales manager for the Raymond Bros. Pulverizer Co.

MECHANICALS

Dewey, Robert S., m'14, is with the Humble Oil and Refining Co., of Houston, Texas.

Geisse, John H., m'17, who has been senior engineer in the laboratory of the Naval Aircraft Factory at Philadelphia, is now vice-president of the Comet Engineering Corp., and is living at 522 Virginia Terrace, Madison.

Grant, Ralph A., m'17, has left the Allis-Chalmers Co. to be director of sales, controls division, for the Leland Electric Co. at Dayton, Ohio.

Maxfield, Terrell B., m'22, is now manager of the Ronald Mattox Company. Address: 1347 North High Street, Columbus, Ohio.

Schowalter, Clarence H., m'26, is working as a designer in the aeronautical engineering division of the Lycoming Manufacturing Company. Address: 815 Walnut Street, Williamsport, Pa.

Smith, R. R., m'28, was in Madison for the Purdue game. "Smitty" is well known to readers of the Wisconsin Engineer for the clever cartoons he drew for us as a student. He is now in the tool design department of the International Harvester Co. at Chicago, and lives at 331 South Central Park, Chicago.

Whelan, William M., m'23, reports a change of address from 1696 Massachusetts Ave., Cambridge, to 280 Parkside Ave., Brooklyn, New York.

ELECTRICALS

Baker, William, e'28, is in the radio department of the American Telegraph and Telephone Company at Chicago. Bill was recently sent to Winnepeg, Canada, to take charge of the broadcast by Sir Harry Lauder. He is living at the Austin Y. M. C. A.

Fisher, R. R., e'25, is still with the Bell Telephone Company as transmission man No. 1 in the Madison district of the Wisconsin Telephone Company, specializing on foreign wire relations. Address: Oregon, Wisconsin.

French, Newell E., e'23, says he is still making gas and electric rates — and enjoying it. He claims Pittsburgh is a fascinating city and says that after a year's residence

(Continued on page 114)

Engineering Review

IMPROVEMENTS IN THE IMHOFF SEWAGE SETTLING TANK

For the preliminary treatment of sewage the Imhoff tank is undoubtedly in widest use. Accumulating experience shows that some of its disadvantages are due to the basic principal of construction rather than to individual operating conditions.

One chief source of trouble in the Imhoff tank arises from the fact that the scum remains in the sedimentation compartment with results more or less harmful according to the nature of the sewage and the consequent nature of the tank action. The sludge passes automatically through the slot at the bottom of this compartment, but the removing of the floating matter from time to time which remains in the sedimentation compartment is a disadvantage in Imhoff tanks.

Another disadvantage of the Imhoff tank is that there is not enough surface area to provide for the gas to pass off freely from the rising gas-filled scum, and consequently the sludge is not able to settle because it is held up by this scum. This is the basic cause of foaming and spitting. Due to the scraping of the surfaces within the sedimentation compartment to remove the sludge, the clarifying efficiency of tank is materially reduced, and considerable operating costs are involved.

Various attempts to eliminate these disadvantages led to a new construction in which the sedimentation compartment is submerged. It has slots at the bottom for the removal of the sludge just as in the Imhoff tank, but it has in addition, slots at the top to permit the floating scum to pass out of the chamber.

Since it is surface area which is so desirable this type of construction solves the problem because the submerged compartment leaves the whole area of the tank free for the collection of scum. And when the whole area is available it is sufficient for the complete release of the gas according to the article in the Engineering News-Record of October 24, 1929, page 647. One of the salient features about this type of construction is that the walls are self-cleaning because of the steeper slopes which necessarily result with greater depths. It has not been necessary to clean the walls in any of 150 plants, some of which have been in operation for fifteen years. The attendance has been reduced to one man where it was necessary to employ three or more men formerly. Because of the elimination of hand cleaning as well as foaming and spitting, odors are completely eliminated.

In the above reference there are examples and interesting comparative data on operating conditions.

THE DEVELOPMENT OF THE ST. LOUIS AIRPORT

The airport in St. Louis is under the supervision of a city airport commission headed by a director of public welfare, and the engineering service of the city was not connected with it until after land had been acquired. For a considerable length of time no drainage or sewerage had been placed except one small line for hangers and no program of development was under consideration.

People insisted upon construction on a large scale and the problem was submitted to Chief Engineer, W. W. Horner, Sewers and Paving, of St. Louis. He decided the main problem was the immediate construction of airport improvements with no experience at all in methods of practice, no developed technique with which to work, and no basic designs for the construction. All of the construction had to be taken on a purely experimental basis and a definite fund was placed at his disposal by the commission.

The first improvement that was undertaken and immediately necessary was the construction of a concrete apron extending the full length of the buildings, 1500 feet, and a width of 200 feet. It was so designed that rails or fences would be set in sockets 60 feet from the buildings leaving 140 feet for servicing planes, thus separating them from crowds. The cost of construction was $2.10 per square yard of concrete.

Though the field comprises 600 acres, the two main parts are separated by Cold Water Creek. This creek represented a drainage area of more than 6,000 acres. A proper sewer or culvert to carry off this drainage instead of the creek would have involved a 25 foot section. The cost of this section would have amounted to more than the whole cost budgeted for construction. The simplest solution of the creek problem was to detour the creek to the extreme edge of the undeveloped area; this involved removal of a twenty foot knoll at one point. The detour ditch, as constructed, would permit drainage 50 per cent greater that that of the farm drainage district. It was undesirable to have rain remaining on the field in excess of two hours after it had fallen.

The part of the area to the west of the creek, which, heretofore had been used as a landing field, was graded at a slope of about 1½ per cent of the western edge to the general line of the bisecting creek. The field grading involved the handling of about 225,000 cu. yards and the diversion ditch and branch drainage ditch of about 165,000 cubic yards of earth. A general research of similar drainage problems yielded nothing to the engineer as no study had been used by the various gold club engineers of rainfall conditions and effects on the soil. Even the climate experts of the immediate vicinity could not clarify the situation to any great extent. Forced experimental research in the field was the only way out and two civil engineers of the department, Bloss and Miller, were detailed to obtain data covering conditions on a thirty acre area.

The result of their experiments was that a rain of about 45 minutes gave the severest load and that a proper handling of the water with all allowances for storage and water in transit required a discharge capacity for the mains of about 0.42 cubic feet per second per acre; about 30 per cent of the rainfall rate.

The final judgment was based on the following conclusions:

(a) That a turf surface would be maintainable over the greater portion of the field for years to come, but the portions of the field subject to the heaviest travel would have to be oil treated.

(b) That impermeable surfaces should be placed on parts of the field, asphalt, concrete, and bitumen runways.

(c) That the runoff from the paved areas would amount to 90 per cent and greater.

The full list of the runways is: First, the original experimental runway, about 3 in. thick, costing 90 cents per square yard under experimental conditions. Could be duplicated for 75 cents. Second, the hot mixed pavement, full four inches thick, actually costing $1.40 per square yard, which could not be duplicated for less than $1.60 per square yard. Section B, a full 4-inch bitumen pavement in which the asphalt-bound earth is used to the greatest possible degree, costing 90 cents per square yard. Fourth, Section C, a 4-inch asphalt macadam pavement in which the asphalt-bound earth is used for a filler, costing 99 cents per square yard. Fifth, 6-inch reinforced-concrete slab, costing $2.00 per sq. yd. Finally, and to round out the series, a strip about 200 feet wide and 1,500 feet long adjoining the apron was oiled with one gal. to the square yard and heavily worked with the road maintainer. This strip is also used as a runway.

A very interesting detailed account of the airport problem can be gotten on page 716 of the November 7th Engineering News-Record.

ARTESIAN WATER SUPPLY OF MEMPHIS, TENN.

The Geological Survey, United States Department of the Interior, has undertaken an investigation of the ground-water condition in Tennessee in cooperation with the State Geological Survey. As a part of this larger program, about two months were spent in Memphis and vicinity during the summer of 1928 by F. G. Wells, of the United States Geological Survey. Automatic water-stage recorders were placed over representative wells and obtained continuous records of the depth to the water level in these wells. These records show with much precision the relation between the withdrawal of artesian water and the under-ground inflow of water to recharge the artesian reservoir. The longer the period covered by such records the more accurate are the conclusions that may be drawn. For this reason it is planned to continue observations at Memphis for several years.

Manuscript copies of a preliminary report giving the data that have thus far been obtained and such generalizations as can safely be made at this stage of the investigation, together with a map of Memphis showing the location of wells, tables of well data and chemical analyses, and illustrations, are now open for public inspection at the office of the Tennessee Geological Survey at Nashville, and at the Memphis Chamber of Commerce. This report gives a brief history of the artesian water development of the area from 1867 up to the present time. The geology of the region is described, with particular reference to those formations that are important as producers of water. The Holly Springs and Grenada formations are the two most productive water-bearing formations in the area. The Holly Springs formation is encountered at about 450 feet below the surface and continues to a depth of about 1,000 feet. The Grenada formation has a maximum thickness of 400 feet and lies about 75 feet below the surface. The Ripley formation, which also yields considerable water, is encountered at a depth of about 1,300 feet.

The total average daily pumpage from both public and private wells was 37,385,000 gallons in 1920 and remained below this figure until 1928, when it amounted to 38,600,000 gallons. It is estimated that in 1928 about 2,000,000 gallons of water a day was pumped from the Ripley formation, the remainder coming from the group that includes the Grenada and Holly Springs formations.

The development of water supplies in Memphis during the last 10 years has caused an increase of over 1,000,000 gallons in daily pumpage, but as there has been a large increase in the area drawn upon by wells, the lowering of the water level has been less than if the wells had been concentrated in a smaller area. In view of the large quantity of water pumped, the loss in head is not great; and it is believed that additional supplies can be obtained, but future developments should be distributed as widely as possible. If more water is pumped, the head will doubtless decline further, but for any increase that is expected in the immediate future the decline would hardly be great enough to be serious.

Analyses of water from wells in the Grenada formation show that in general it is fairly soft and has a moderately low content of dissolved mineral matter. Except for the slight trouble and expense involved in the removal of iron, water from the Grenada and Ripley formations is likely to be thoroughly satisfactory for all ordinary purposes.

BASING SEWAGE-WORKS REQUIREMENTS ON STREAM POLLUTION STUDIES

Municipalities often find it difficult to overcome the antagonism of the taxpayers toward expenditures for sewage-disposal purposes. An effective way of meeting a situation like this is to place before the taxpayers the facts concerning their particular condition, obtained as a result of a thorough investigation, by parties in no other way connected with other phases of the problem. Such an investigation should reveal the necessity of advisability of a sewerage disposal plant, and the degree of treatment which the plant should be designed to accomplish. When an engineer has data at hand of this nature he will be able to design and construct a plant suited to the local needs.

Most every engineering project has certain peculiarities of its own. Ofttimes these conditions are the governing factors as was the case in the city of Middleton, New York, whose taxpayers defeated the bond issue plan upon first presentation and saved more than $100,000 by authorizing the bond issue necessary for construction after an independent investigation as described in the *Engineering News-Record* of November 21, 1923, page 813.

BUILDING 4000-H. P. DIESEL ENGINES

Diesel engines have undergone a great increase in popularity as the power plants of freight and passenger vessels, not to mention their great increase as land engines for driving compressors and generators and their continued use as the motive power for submarines.

(Continued on page 108)

Campus Notes

PROF. WARREN J. MEAD APPOINTED ON CENTURY OF PROGRESS COMMITTEE

Prof. Warren J. Mead of the University of Wisconsin is a member of a committee comprising more than a score of the leading geologists of the country representing many of the principal educational institutions and industrial organization laboratories, who have combined their energies in an effort to develop a plan whereby the progress in geological research during the past hundred years may be graphically depicted at the Chicago Century of Progress celebration in 1933.

The geologists are collaborating under the supervision of the National Research Council's Science Advisory Committee, which has been asked by the Century of Progress trustees in Chicago to work out a science theme as the dominant feature of the forthcoming exposition.

The science theme will take the form of a panorama dramatizing the march of science in all its various phases in both the pure and applied fields.

PROF. HAROLD B. SMITH PRESENTS LECTURE TO A. I. E. E.

Prof. Harold B. Smith, national president of A. I. E. E., gave two lectures in Madison Nov. 29, addressing junior and senior engineers in the morning on "The Quest of the Unknown", and the Madison chapter of A. I. E. E. at a banquet in the evening. Prof. Smith is head of the department of electrical engineering at Worcester Polytechnic institute, and is well known as a research worker.

WISCONSIN CIVILS MAKE PARK SURVEY

Prof. Ray S. Owen, assisted by W. B. Hovey '31, J. V. Hovey '32, Henry Gremmer '32, Aubrey Wagner '32, and Byron Redeen '32, made a survey of the boundaries of Gibraltar rock, also known as Richmond Memorial park, near Lodi, Nov. 16.

MECHANICAL ENGINEERING SOCIETY HEARS CHICAGO ENGINEER ON RIVETING

Welding has not yet replaced riveting in building operations because no satisfactory method has yet been devised for ensuring that a weld has been perfectly made, Mr. A. F. Jensent, president of the Hanna Engineering Works, of Chicago, told members of the student chapter of the American Society of Mechanical Engineers at a meeting of the chapter held in the College of Engineering on November 19. Mr. Heineman and Mr. Weldon, also of the Hanna Engineering Works, assisted Mr. Jensen in answering the question that were elicited by the address and three reels of movies that showed recent advancements in riveting practice.

A. S. M. E. INITIATES

The following students were admitted to membership in the society at the meeting:

Juniors: Arnold Meyer, M. G. Huber, Alex Cowie, Abe Sher, W. J. Leininger, G. W. Miller, C. N. Janishewski, W. D. Simpson, A. L. Groth, G. W. Brewer, D. J. Ryan, W. H. Goeltz, Norbert Steckler.

Sophomores: W. S. Zuzuly, C. R. Stoelting, S. E. Hicks, J. G. Green.

Senior: Arthur H. Wehmeyer, and Robert Loewe.

Charles Quinn, a junior mechanical engineering student was elected to the Polygon, an organization made up of representatives of all student engineering societies. This organization also is planning an interesting program of events for the present school year.

POLYGON TO SPONSOR LECTURES

Polygon is sponsoring a series of lectures by prominent practicing engineers. These lectures are open to all students in engineering and it is essential that the students will co-operate in making these meetings a success.

The first of these lectures was a talk by Joshua D'Esposito, a prominent consulting engineer and formerly engineer in charge of construction of the Union Station at Chicago, on December 11. Mr. D'Esposito spoke on "Human Engineering." The subject concerned the handling of labor during the construction of the Chicago Union Station.

MR. ARMSTRONG TO ADDRESS A. S. M. E.

Mr. Armstrong, of the American Appraisal Company, will address the members of the society at a meeting to be held on December 17, at 7:00 P. M. Future meetings of the chapter promise to be highly instructive and interesting if plans now being considered by the program committee materialize. Latest developments in the field of engineering will be brought to the attention of the society, both through the aid of movies and by speakers. The exact dates and subjects of future meetings will be announced to society members and their attendance is assured to be a profitable one.

BURGESS LAUDS CHEMISTS' WORK

Emphasizing the opportunity in the university to prepare for the chemical engineering profession, C. F. Burgess, first professor of chemical engineering here, and founder and president of the Burgess Battery company, addressed the members of the Wisconsin chapter of the American Institute of Chemical Engineers Tuesday night, Nov. 26, in the chemical engineering auditorium. Jack H. Lacher '30, presided over the meeting.

Prof. C. P. Watts of the chemical engineering department told briefly of his work under Mr. Burgess who started the first course in chemical engineering in the university about 25 years ago.

Compliments Work

Both Prof. Watts and Prof. O. L. Kowalke were students under Mr. Burgess and took over the department when Mr. Burgess left the professional field for manufacturing in 1913.

(Continued on page 112)

Side Shots

By Robert J. Poss, c'30

THE EULER (Oiler) COLUMN

A column devoted to the issuing awards for notable work in Engineering.

This months awards:

1. A stringless tennis racquet to the senior civil who wrote on a recent exam in water supply: "The water seeps thru the impervious layers overlaying the filter crib."

2. A pair of silk hip boots to the sophomore electrical who told his econ instructor that "a boycott is a davenport's brother."

3. .0027 votes toward the free car given away according to ad on page 63 of *College Daze* to the senior in Seminar 2A who wrote, "Plebiscite is a name given to first year men at West Point."

4. The traditional gold toothpick awarded by the Daily Cardinal Skyrockets to the Prof. who is kicking on the quality of present day gasoline —sez he: "Columbus got about 8,000 miles to the galleon."

5. A gauze necklace to the Junior miner, who after the writer had shot a duck; said, "You should have saved the shot — the fall alone would have killed him."

HELPFUL HINTS TO FRESHMEN

If anyone sends you spats for Christmas, have them half soled.

A bump on the crazy bone won't show under a hat.

Riding in a patrol wagon is all right in a pinch.

—*Armour Engineer.*

AT THE MINNESOTA GAME

Wis. Stewdent: (hearing knock at the door) Yes!

Bell Hop: A message from a friend.

First Drunk: Slip it under the door!

B. H.: Sorry, Sir; it'll spill if I try to.

Sap: "If you stay in that position much longer I am going to lose my self control."

Dame: "Well, I can't stay in this position all night."

—*Exchange.*

ENGINEERING ENGLISH?

The following are some of the "prize" answers received in a vocabulary test given by Prof. Van Hagan:

tandem—trance, riot, uproar.
category—bag of tricks.
mural—on the campus, landscape.
palpable—pleasing to the taste, very fine, excited.
facade—a period of five years.
ludicrous—delicious.
askance—can have for asking.
entity—a title as an abstract or deed.
exorcise—to kill one's wife.
perogative—a laxitive.
intrigue—poison for insects.
Fauna—refuse from a certain bird.
Flora—a species of animal somewhat like the faun.
chimera—animal which changes color with environment.
weal—small water animal.
nostaglia—bunch of flowers.
marital—pertaining to the sea.
maritime—period of marriage.
bovine—sad, melancholy, pertaining to a dog.
polygamy—worshipping more than one god.
equestrian—a judge.
pseudo—a Mexican coin.
tent—one who occupies another's property.
science—dealing with things that are not understood.

COULDN'T WAIT!

A young M. E. manufacturer in Des Moines ordered a carload of material from a Chicago jobber.

The jobber wired him: "Cannot ship order until last consignment is paid for."

The M. E. wired back: "Can't wait so long; cancel the order."

—*Exchange.*

WHAT! NO ENGINEERS?

Small Boy: "Mother, do they have electric plants in Heaven?"

Mother: "No Sonny, it requires Engineers to build electric plants."

PROSPECTIVE GROOMS; ATTENTION!

Real Estate Agent: Can I interest you in a home, Lady?

Lady: A home? I'll say not! Why I couldn't use one. I was born in a hospital, educated in a college, courted in an automobile, married in church, we live on delicatessen out of a paper bag, spend the mornings on the golf links, the afternoon over a bridge table, the nights in a movie or a jazz palace. And when I die, I am going to be buried from the undertakers. Say, all I want is a garage, with maybe a bed room over it.

—*Coop Engineer.*

MODERN ART?

It was visiting day at the insane asylum. An inmate was busily engaged in dabbling at an empty canvas with a dry brush. A visitor wishing to humor him, asked what the picture represented.

"That," said the nut, "is the Israelites being pursued thru the Red Sea."

'Where is the sea?"

"Why, that's rolled back to let the Israelites pass."

"Where are the Israelites?"

"They're just gone by."

"Where are the pursuers?"

"Oh, they'll be along in a minute."

—*Auburn Safety Valve.*

EFFICIENCY

"Rommy" Brotz, '31, thought he was picking up a little easy money when he saw a dime laying at his feet, but when he stooped over to get it, his slide-rule dropped out of his pocket, breaking the slide, and causing a net loss of 90 cents.

FORLORN FIGURES:

A stuttering Scotchman talking to his wife over trans-Atlantic telephone.

LIBRARY RULE 23578

To get a volume: multiply the area of the base by the altitude.

THE ELECTRICAL AND MECHANICAL ENGINEERING INSPECTION TRIP

(Continued from page 92)

about 90% of all the frames used in the United States exclusive of the Ford frames. About one and one half hours is required to complete the cycle of frame manufacture from the raw material to the finished frame. Five hundred fifty-two operations are performed on a single frame. The welding process, which was not devulged to the group in either theory or practice, is a special type and was developed at this plant.

After the inspection of the A. O. Smith plant the electricals departed to the Allen Bradley company and the mechanicals went to the Riverside Pumping station.

One o'clock that afternoon found the groups in a class room of the T. M. E. R. & L. company's Public Service Building. Every one seemed in high spirits either because of Milwaukee's famous lunches (Pabst included) or because of the prospects of a sleeping session during the lecture on the Lakeside Power station. Following the lecture the station was inspected by both groups. After the noisy afternoon, the crowd finally left the plant and boarded the waiting special car. As usual the motorman received the most unusual advice on how to operate the car and Weisshoppel even offered to show him a few tricks such as jumping off the track and playing tiddle-dewinks with the automobiles.

Later in the evening the Triangle boys dined at the Schroeder hotel (yet, they managed to get dates). As the program proceeded the boys, Guth in the lead, induced Bobby Meeker to play a special request number for them during his broadcast over WTMJ. When the time came Bobby made the announcement in very flowery language for the benefit of the Triangle boys in Madison, and then he proceeded to play "How Dry I Am"; whereupon the Triangle cavalcade of Sir Walter Raleighs decided they were all wet and mingled with the crowd on the dance floor.

Wednesday proved to be a big travel day for all. At 7:45 A. M. (imagine the shock) a Chicago, North Shore and Milwaukee Railroad special car was boarded and the group proceeded to the Nordberg Manufacturing company, manufacturers of Diesel Engines. The inspection of the plant was accomplished in short order, and, with two hours on their hands, the groups began to mill around and become noisy. Suddenly came the announcement that the radiator plant would be visited to consume the remaining two hours of the schedule. This too, completed ahead of time and the inspectors amused themselves by walking on the rails, throwing stones, telling stories, and other forms of indoor sport. Eventually the special car arrived and the group proceeded to Kenosha where all enjoyed a lunch by the grab and stuff method. Stan Watson won the contest for catching tossed soda crackers in his mouth. The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waitresses in the cafe had enough dates for three months before our group decided to withdraw to the works of the American Brass company. Here the heavy rollers, drawing machines and the like were all inspected. Some one spied a bicycle rack as the group was leaving the plant, and, upon investigation, the inspectors found that the majority of men working for the company rode bicycles to and from their work.

Besides having good looking, amiable waitresses, Kenosha also nourishes the plant of the Nash Motor Cars company. All the cars start on the assembly line as nothing but a bare frame and at the end of the line come out a finished car ready to be driven away under its own power. During the group's sojourn at this plant one of the new Nash eights was assembled and after viewing the finished product Oneill, the specimen collector, was again tempted to ask for a working sample to include in his report. At five o'clock the party boarded their special car on the North-shore line and was wafted into the Windy City, Chicago.

"All aboard" at 8:15 the morning of the seventh found Johnson and Seillstad still sleeping in their comfortable room at the hotel while the rest of the party entrained for the Universal Portland Cement company's Buffington plant. On arrival at the offices of the cement company the inspectors were divided into groups and outfitted with long flowing gowns and tiny khaki caps. Some of the fits were rather amusing, but even "Jimmie" Watson and some of the other "shorter" members of the group found caps that actually covered their ears. When outfitting was completed the groups proceeded into the plant where the long 100 foot inclined rotating tubes swallowed the mixture of limestone and slag into an earthly hell of long gas flames. After viewing the sacking of the cement, the storage of the bags, and the bag cleaning machinery, the party shook off some of the cement dust and departed for the Gary Mills of the Illinois Steel Corporation.

After partaking of a light lunch (very light for some but extremely heavy for others) the student inspectors, not down-hearted but very weary, trudged to the 1440 acres of the Gary Mills. Once inside the mill the blast furnaces occupied the attention of the men for a short while. Even Bischel and Bunch began to heat up for the coming engagement of the evening. After visiting the gas engines, the unloading dock, and the ingot cooling room, the party entered the rolling mills. Here a 10,000 ton hydraulic press forced red hot rectangular pieces of steel into car wheels; the rollers narrowed the size of huge ingots and finally formed them into steel rails; and the wire rollers turned out hundreds of feet of wire per minute. With the thought of the hydraulic press imbedded in our mind the party returned to Chicago for a night of hilarious entertainment at some of Chicago's world famed theaters, many of which must be located near State and Congress streets if the trend of the engineering minded inspectors is to be given any weight.

Friday morning found the entire party with lead legs which refused to function without an extreme effort. Tardiness prevailed and the Yellow Cab company did a rushing

business to the Hawthorne works of the Western Electric company which works employs about 39,000 men. On the trip through the plant the questions were few and the notebooks of the Tuesday before had completely disappeared. To brace the spirits of the weary travellers the Western Electric company were hosts at luncheon to the entire party. Wisconsin songs and cheers were very much in evidence for a Wisconsin man may lose the use of his legs and arms but his voice goes on forever.

At the conclusion of the meal, busses were provided to carry the straggling gang to the Commonwealth Edison Stations. Three hundred twenty thousand kilowatts are able to be delivered by the larger of the two stations and the stations together would be able to supply Milwaukee with power should anything go wrong with the Milwaukee system. After a hurried investigation of the workings of the stations the party adjourned for the day and all proceeded to the hotel to sleep, but some of the boys Tieg-like were detained to the wee small hours of the morning by rent-a-cars that failed to function.

Saturday the mechanicals, such of them that were able to get up, visited the Underwriters Laboratories while the electricals inspected the State-Central Exchange of the Illinois Bell Telephone company. At 10:30 came the day of reckoning for some while for others it merely meant the untying of some apron strings. Over the week-end some of the electricals and mechanicals regained enough strength to attend their eight o'clocks Monday morning, but many an alarm clock sounded reveille unheard.

ENGINEERING REVIEW

(Continued from page 99)

The reason for their increased popularity in ocean-going vessels is the great efficiency and fuel economy of this type of motor, which results in lower operating costs, as well as the smaller size of the installation for a given power output, than any other engine, and the small space required to store the fuel.

Although European concerns first gained prominence in the manufacture of Diesels, due to their being invented in Germany, lately American manufacturers have made great strides in this type of engine building, and recently two engines of 4000-H. P. each were produced by the Hooven, Owens, Rentschler Co., Hamilton, Ohio.

These huge engines were built for the United States Shipping Board for driving two 10,000-ton freight vessels having direct drive from the engines.

Over 2000 drawings were required for these engines, which had more than 10,000 parts apiece. The cost for each engine was $300,000. The engines are of the four-cylinder, two-cycle, double-acting type, weighing about 400 tons each and measuring approximately 30 ft. in length and 28 ft. in height. The cylinders, which are 27½ in. in diameter and approximately 7 feet long, are made in two parts and must be true to size within minus 0.000 and plus 0.004 inches.

The pistons are of a double-acting design, having upper and lower sections. Their stroke is 47½ inches, and the combustion load on each piston is about 300,000 pounds.

The operating temperature of the pistons is between 800 and 1000 degrees F. The pistons, cylinder heads, and cylinder linings are water cooled to enable them to withstand the high temperatures to which they are subjected. The pistons weigh 2000 pounds and are equipped with split hammered rings. The weight of each complete connecting rod is four tons, and the distance between the centers of the bores is 10 feet. The connecting rods are made of a forged-steel central piece and cast steel boxes and caps having babbitted linings. The castings are fastened to the central piece by 5⅜-in. bolts. The crankshaft of this mammoth power plant weighs 38½ tons and runs at a speed of 110 r. p. m. to develop the rated 4000 h. p. The bed plate of the engine weighs 33 tons.

An unusually high degree of accuracy for such large work was maintained in the machining of the principal parts of these huge engines. The crank-pins must be ground to size within plus or minus 0.001 in. on a diameter of 19¾ in. The allowed deviation in the center-to-center distance between the main bearings and the crank-pins is only 0.0025 in. on a specified length of 0 inches.

For the building of such engines, a plant must be equipped with both heavy and light types of machine tools. Heavy parts like the crankshafts, connecting rods, cylinder blocks, etc., require large and powerfully designed shaping machines, while the thousands of smaller parts must be finished on correspondingly smaller machines. The operations in this plant are carried out with a view of reducing the amount of hand-fitting to a minimum.

These Diesel engines and others of smaller size are built under the license of the Maschinenfabrik-Augsburg-Nurnberg Co., Augsberg, Germany, known as the M. A. N. Company. —*Machinery.*

PAUL BUNYAN — THE SURVEYOR EXTRAORDINARY

(Continued from page 91)

When he took the contract to log the state of North Dakota he used it in making his estimates, but lack of hogs enforced a too rigid economy in lubrication and as a result of an overheated bearing the machine caught fire and burned up.

Paul had always intended to return the state line when he got through with it, but the fire made it impossible This eventually caused a dispute and a lawsuit between the two states, and it was not until the summer of 1929 that the position of the old state line was relocated.

An ad in a pre-war paper found under the rug at a fraternity house reads: For Sale. Whiskey that has been drunk by all presidents from Jackson to the present day.

Watch For It

In the January issue the *Wisconsin Engineer* will present a story on a recent scientific invention, *The Gravity Screen.*

CAMPUS NOTES

(Continued from page 100)

"In 1881 Wisconsin had one of the few outstanding chemistry departments in the country," said Mr. Burgess. He spoke on the historical development of the department and stressed particularly the part the department has played in the manufacture of gas, which is a branch of chemical engineering.

Used by Medical School

With $10,000 granted by the Carnegie institute of Washington for research with pure iron which had been developed in the laboratory, Mr. Burgess and his colleagues produced many alloys. Many have since been developed from the pure iron.

DEAN TURNEAURE ATTENDS ANNUAL COLLEGE FACULTY MEETING

Prof. F. E. Turneaure, dean of the engineering school, Dean Harry L. Russell of the college of agriculture, and several members of the engineering and agriculture college faculties, attended the annual meeting in Chicago last month of all land grant colleges and universities.

WISCONSIN STUDENTS ORGANIZE FLYING CLUB

A University of Wisconsin Flying club, composed of students interested in aviation, was organized Nov. 7 at a meeting held in the engineering building.

Frederic Hansen, Raymond Wagner, Edward Page, and Richard Callendar were appointed temporary officers. The possibility of the club's affiliating with Kappa Gamma Delta, national professional aeronautical fraternity, was considered.

Page and Hansen spoke on the founding of a flying club. It was brought out that the operation of an airplane by the club would cost about $12 or $14 an hour.

Forty persons present at the meeting signified their intention of joining the club.

NATIONAL PRESIDENT PRESENT AT CIVILS' BANQUET

Dean Anson Marston, national president of the American Society of Civil Engineers was the principal speaker at the ninth annual banquet of the student chapter of A. S. C. E. held at the Hotel Loraine, Tuesday, December 3. Dean Marston is a nationally known civil engineer. He graduated from Cornell University in 1889; Dean Turneaure graduated with the same class. He has been connected with a great many noteworthy civil engineering projects. At present he is engineer in charge of surveys for the Nicaraguan Canal.

The committees in charge of the banquet were: George Washa, chairman; Ed Hulbert, Publicity; Leo Peleske, Stunt; Arthur Bright, Programs; Walter Tacke, Finance. Mr. Homewood of the hydrauics department was toastmaster.

A. S. C. E. VISITS PRAIRIE DU SAC

About 50 engineers took the opportunity of visiting to the Prairie du Sac power plant of the Wisconsin Power and Light Company on Saturday, November 23. This trip is the second of a series sponsored by A. S. C. E. The first trip was made to the Nine Springs Sewage Disposal plant. Arrangements are under way for a third trip to the Madison Water plant. This plant embraces a central pumping plant, two sub-stations and a few reservoirs.

ALUMNI NOTES

(Continued from page 97)

he has become quite a booster. Address: 3 Hemlock St., Mt. Lebanon, Pittsburgh, Pa.

Heuser, John U., e'16, district manager for the Cutler Hammer Co., is president of the Electrical League of Milwaukee this year.

Kelhofer, Leon M., e'24, is now associated with Henry L. Doherty and Company, 60 Wall Street, New York, as field manager covering western Michigan selling "America's most popular and most talked of common stock — Cities Service Company Common". Address: 812 Michigan Trust Bldg., Grand Rapids, Michigan.

Magdstick, H. H., e'10, director of commercial engineering, National Lamp Works, is the new president of the Society of Illuminating Engineers.

Miller, Harry I., e'21, is manager of the rate department of the Wisconsin Public Service Corp. at Oshkosh, Wis.

Nowack, David C., e'28, is enrolled in a course offered by the educational department of the Westinghouse Electric and Manufacturing Company. Address: 455 Biddle Street, Wilkinsburg, Pennsylvania.

Sweet, Alva L., e'29, has been transferred from Fort Wayne to the Schenectady works of the General Electric Company. He is enrolled in the advanced course in engineering given by the company. Address: 900 Union Street, Schenectady, New York.

Woy, Frank P., e'03, was married on the 14th of September to Miss Ruth Nell Smith of Sparta, Wisconsin. They will live at 1715 Hoyt Street, Madison, Wisconsin.

Wright, J. David, e'09, is head of the Steel Mill, Electric Arc and Industrial Furnace Equipment, Electric Welding and Centrifugal Compressor Section, and Industrial Engineering Department with General Electric.

CIVILS

Birkenwald, Edward, c'27, who took a post-graduate course at M. I. T. and then went to work for the American Bridge Co., at Gary, joined the engineering staff of the Maine Central R. R. during November. He can be reached at the company's offices at Portland, Maine. He will be engaged in bridge design and inspection.

Fisbeck, Finley L., c'19, staff member of the Engineer during the war, has been recently married. According to information his friends can probably reach him with just "Terre Haute".

Howson, Louis R., c'08, E. E.'12, at a recent meeting of the American Society for Municipal Improvements, presented a paper on "The Sanitary Aspect of The Lake Michigan Diversion Case at Chicago". Mr. Howson, who is a member of the firm of Alvord, Burdick & Howson, consulting engineers of Chicago, states that Chicago can continue to exist and do business at the old stand in spite of the adverse Supreme Court ruling in the lake diversion case, provided that it treats its sewage and purifies its drinking water. "Filtration',, he says, "should be installed at Chicago regardless of whether the diversion from the lake is zero or 10,000 c. f. s." He urges metering in order to control the tremendous waste of water that Chicago indulges in, stating that it has been estimated that with complete metering, Chicago could save in the next 25 years, $233,000,000 in operating and construction costs in its water department and $50,000,000 in the cost of sewers and sewage plants.

Kurtz, Henry W., c'19, former staff member of the Engineer, is now located at 20 Monterey Avenue, Terre Haute, Indiana. It is reported that his little girl, aged 3.675 years, bosses all the kids in the block.

Kutzke, William, c'29, was with the Standard Oil Company during the summer but is now in the contracting business with his father. Address: Portage, Wisconsin.

Lanphier, Ira B., c'16, who has been Associate Engineer at the Forest Products Laboratory at Madison, Wis., was recently appoined director of the Package Research Laboratory at Rockaway, N. J.

Lovewell, Cecil E., c'29, who was severely injured by an excavating machine during the summer, was a visitor during Homecoming on crutches. He expects to go back to work soon for M. B. Gessner, a water works contractor of Toledo, Ohio. Address: 2428 Maplewood Avenue, Toledo, Ohio.

Mackie, James E., c'23, who as secretary of the Pacific Coast Building Officials' Confernece was largely responsible for drawing up a building code that has been largely adopted on the Coast, has recently joined the staff of the National Lumber Manufacturers Association, with headquarters in the Transportation Building, Washington, D. C. He plans to devote considerable time to giving talks to technical students in the leading engineering and architectural schools on the subject of the correct usage of lumber in construction.

Schustedt, Fred N., c'17, who was for several years on the engineering staff of the City of Madison, and later was connected with Municipal Paving Brick Co., of Portsmouth, Ohio, is now airport engineer with Leonard Macomber, Inc., at 664 N. Michigan Ave., Chicago.

Schuyler, P. K., c'21, president of the Federal Bridge Company of New York is the author of an interesting article on the vehicle toll bridge situation in the United States which was published in the October number of Roads and Streets. To those of us who have thought that the highway toll bridge was long ago out of date it is something of a surprise to learn that the number of such bridges increased from 233 to 272 from 1927 to 1929; and that on July 1st of this year 60 such bridges were under construction and 294 additional ones have been proposed.

Sogard, Lawrence T., c'24, once a member of the staff of the Wisconsin Engineer but now an acoustician with the Johns-Manville Co., recently addressed a meeting of engineers at the Sherman Hotel, Chicago. Due to the perfect acoustical qualities of the room the echoes all died away and they couldn't find the subject of the talk — at least, so runs the report.

Shuman, E. C., c'24, is on leave of absence from the Portland Cement Association to conduct a development research program for Koehring Co. of Milwaukee. His address at present is 1074 Maryland Ave., Milwaukee.

Stephens, Clyde K., c'29, is running instrument for the Muskegon River Survey. He writes that he has covered about 125 miles with approximately an equal amount to cover before he is through.

Stoelting, Roland E., c'09, who has been commissioner of public works for Milwaukee for eight years, has resigned to engage in private engineering practice.

Summeril, Franklin J., c'28, with **Heman L. Chase,** c'27, is doing engineering inspection with the Connecticut River Development Company. He writes, "We're having quite a time holding our own out here among the Eli Yales and John Harvards, but we still have faith in Wisconsin." Address: Conn. River Development Co., c/o Staff House, East Barnet, Vermont.

Titus, William J., C. E.'13, chief engineer of the Indiana State Highway Commission, is featured in the Personals column of the May number of Highway Engineer and Contractor. Mr. Titus did his undergraduate work at Indiana University. His graduate work at Wisconsin was in structural engineering and he received the professional degree in 1913. His career covers two years with survey crews, five years with contractors in the construction of

bridges, retaining walls, buildings, and chimneys, four years as consulting engineer on reinforced concrete bridges, and, during the war, structural engineer for the aviation experiment station which the Italian government established at Indianapolis. At the close of the war, Mr. Titus became bridge engineer for the Indiana State Highway Commission, which position he held until made chief engineer, six and one-half years later. He has constructed more than 700 bridges, among them the 1000-ft. reinforced concrete structure over the Wabash river at Attica on U. S. Highway 41, and the 2000-ft. steel and reinforced concrete structure over the White river between Princeton and Vincennes on the same highway. As a side interest, Mr. Titus directs the operation of two large farms.

Thwaits, Edmond H., c'25, is a member of the firm of Douglass and Thwaits, Inc., Consulting Engineers. Address: Continental Oil Building, Denver, Colorado.

Torkelson, Martin W., c'04, C. E.'16, former engineering secretary of the Wisconsin State Highway Commission, was recently appointed regional planning director of the commission. Mr. Torkelson will assist in making a study of the various highway problems of the state.

Zander, Arnold S., c'23, has formed a partnership with **Carl E. Mohs**, c'24, to do engineering work. They have offices at 9 South Pinckney St., Madison.

THE SENIOR TRIP WAS NOT ALL ENGINEERING INSPECTION

(Continued from page 93)

Saturday morning we visited the Illinois Bell Telephone Company and tried to see how automatic telephone equipment worked. In the afternoon most of us saw Wisconsin win its first, last, and only big ten game from Chicago 20-6.

And thus ended a wonderful and interesting inspection trip. I am much richer in knowledge, for on the trip I discovered many new things, for example:

Even engineers carry canes.

A new way to make a gurgling sound when near a bathroom. (See Pete Bolliger for details).

How to go on two dates in Evanston for thirty-five cents.

That it is possible to walk fifteen miles a day with three hours sleep a night.

That Eddie Howes really isn't bashful.

That Jimmy Van Vleet knows a drug store outside the city limits of Milwaukee where you can get good malted milks.

That Pete Bolliger is very cross when he is awakened at three o'clock in the morning.

And last, but not least, how you can get a telegram signed Annie from a flock of Engineers.

JUST BECAUSE

A contractor reports the receipt of the following letter from an indignant citizen who lived nearby:

"Why is it that your steam shovel has to ding and dong and fizz and spit and bang and hiss and pant and grate and grind and puff and chug and hoot and toot and whistle and wheeze and jar and jerk and howl and snarl and groan and thump and boom and smash and jolt and screech and snort and slam and throb and roar and rattle and yell and smoke and smell and shriek and fume and crash all day long?"

This would seem to be a rather difficult question to answer offhand.—*Iowa Engineer.*

A NEW ERA IN STEEL CONSTRUCTION

Oxy-acetylene welding permits a flexibility of design and construction unknown to any other method of joining metals. Long established in other fields of industry, it is now taking an important place in the fabrication and erection of structural steel.

The oxy-acetylene welded joint is as strong as the members themselves. Tough and ductile, it combines those characteristics which assure a dependable structure fully capable of meeting the severe loads and stresses of modern building. There is the added advantage that construction by the oxy-acetylene process is practically noiseless. Oxy-acetylene cutting, too, is indispensable in this field.

Motion pictures (in either standard 35 mm. width or 16 mm. width) showing the application of these processes in the fabrication and erection of structural steel are available to engineering schools and technical societies without cost.

From time to time the oxy-acetylene industry is in the market for technically trained men. It offers splendid opportunities for advancement.

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Resident Engineer
University of Pennsylvania 1923
Crew 3 years Varsity Club
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Sales Representative
University of Nebraska 1924
Football 3 years
All American 1923
Track 1924

One of a series of advertisements featuring College men serving this industry.

The Linde Air Products Company—The Prest-O-Lite Company, Inc.—Oxweld Acetylene Company—Union Carbide Sales Company—Manufacturers of supplies and equipment for oxy-acetylene welding and cutting—*Units of*

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York, N. Y.

RESTORING SPEECH

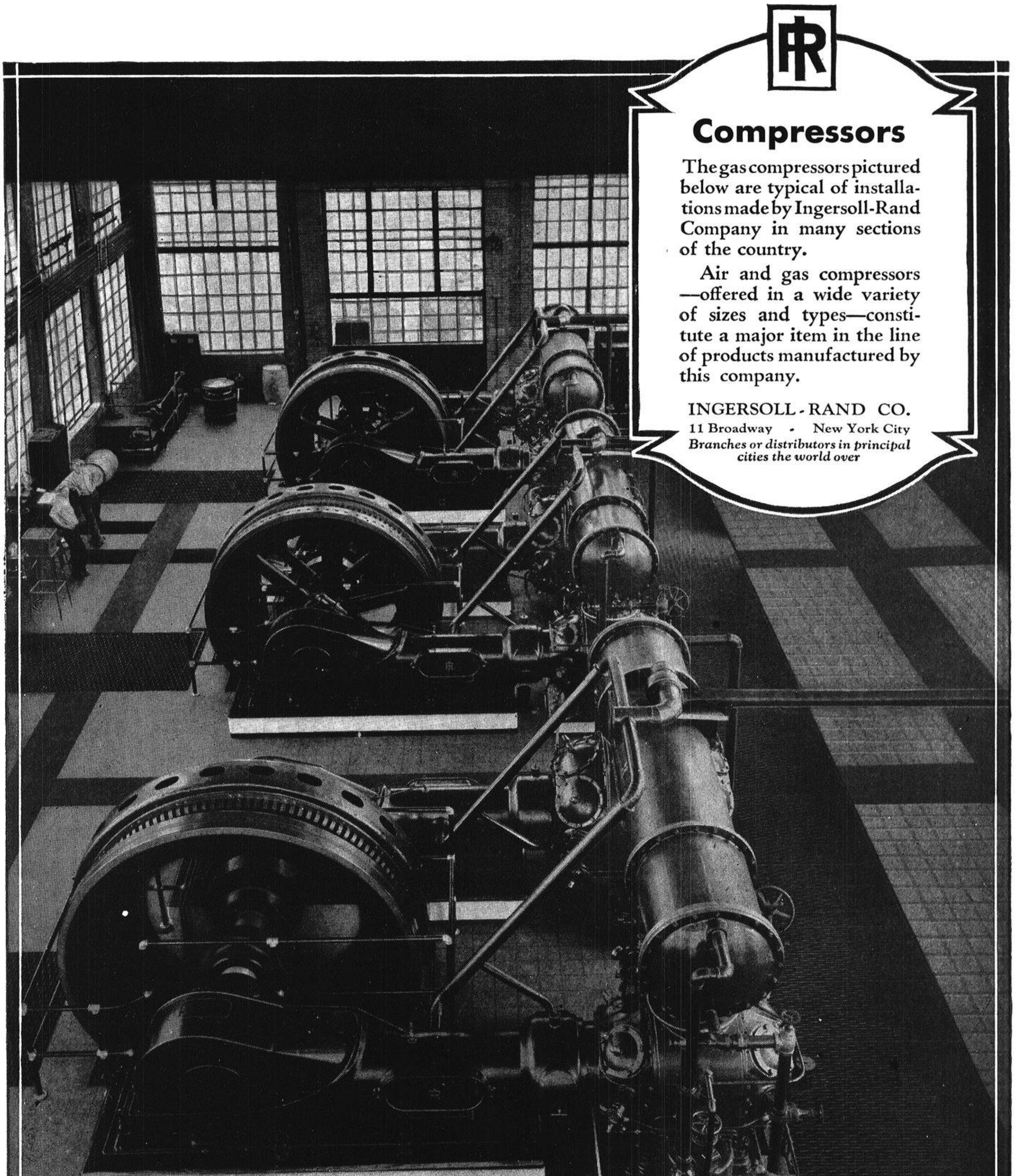
(Continued from page 90)

language there is no connotation of the loneliness which settles around one who can no longer talk, nor of the joy which comes to him when the power of speech is restored.

Instead of a pair of vocal cords, the vibrating element in the artificial larynx is a thin metal reed, clamped at one end and free at the other. One of the metal tubes leading from the artificial larynx is connected by means of a rubber tube and coupling pad to the termination of the windpipe on the front of the neck. The user blows air from his lungs through the larynx and so sets the metal reed in vibration. This vibration alternately stops and starts the flow of air and generates a train of sound waves similar to that generated by the vocal cords of a normal person. The sound, whose fundamental frequency must be about 125 vibrations per second for a man's voice and 250 vibrations per second for a woman's voice, and which must contain a large number of overtones, would not be recognizable as a speech sound. It is introduced into the mouth of the speaker by the outlet tube of the artificial larynx and the speaker goes through the ordinary motions of speaking with his tongue, lips, and the like. The resonating action of the mouth, throat and nasal cavities manufacture out of the basic sound produced by the artificial larynx the voiced speech sounds. The sounds of the unvoiced group are produced by blowing air through the larynx in such a manner that the metal reed is not thrown into vibration and modifying this air stream with the tongue, lips and teeth. A breathing hole placed in the side of the instrument enables the user to inhale air into his lungs. This he covers with the thumb when he desires to speak. An adjustment is provided for changing the pitch of the larynx so that it can be used by either men or women. By continual practice people can become very proficient at speaking with an artificial larynx and so be restored to the happiness and useful normal activities which attend the power of speech.

A normal person whose larynx has not been removed can, with a little practice, learn to speak with an artificial larynx. The air to operate the instrument cannot, of course, be supplied from the lungs; the larynx is connected to a small bellows operated by hand. Air is forced from the bellows through the artificial larynx, and the sound is thence introduced into the mouth. The speaker then goes through all the motions of talking, being careful not to produce a sound with his own vocal cords; and the artificial larynx, with the help of his mouth, throat and nasal cavities, talks for him. Aside from its value in studying the mechanism of speech production and as a means of demonstrating the artificial larynx, this method of using the instrument is of use in restoring the power of speech to mutes or to persons who, from some other cause than removal, have lost the use of their vocal cords.

Concentrate on yourself for a time and see how soon the world starts to concentrate on you. Notice the crowd that collects and follows your gaze when you stop and look up.


IR
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The gas compressors pictured below are typical of installations made by Ingersoll-Rand Company in many sections of the country.
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