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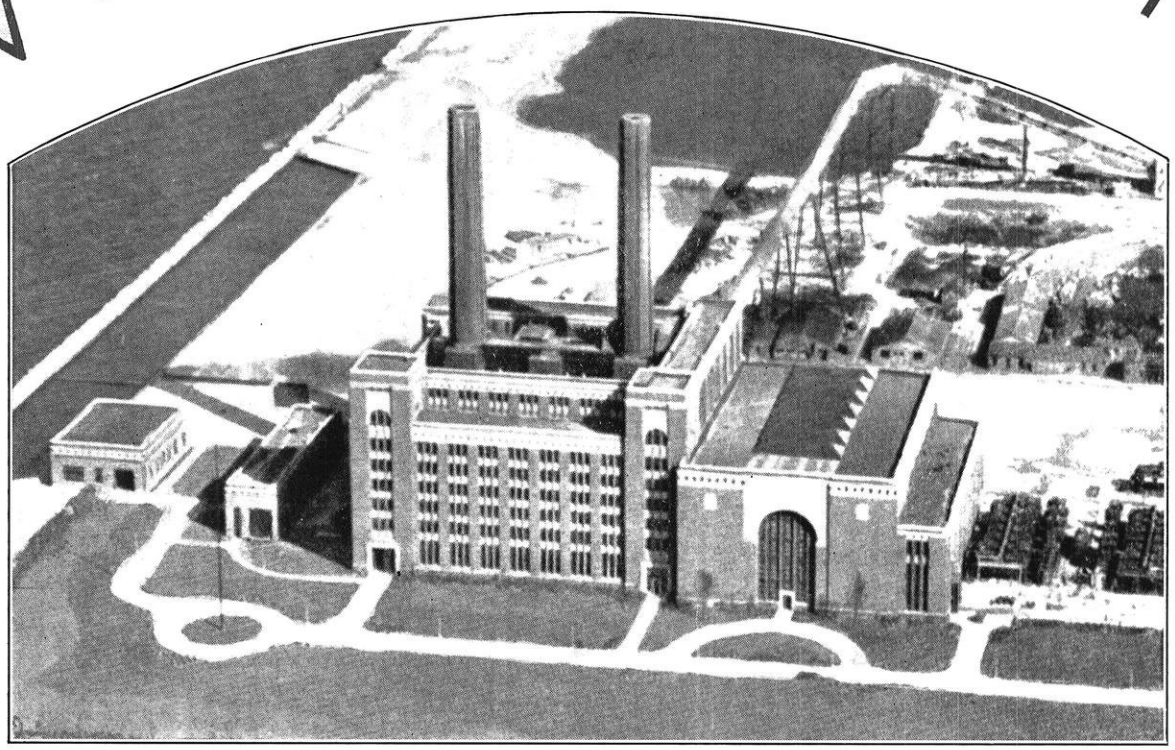

STATE-LINE GENERATING STATION

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VOL. XXXIV, NO. VII APRIL, 1930

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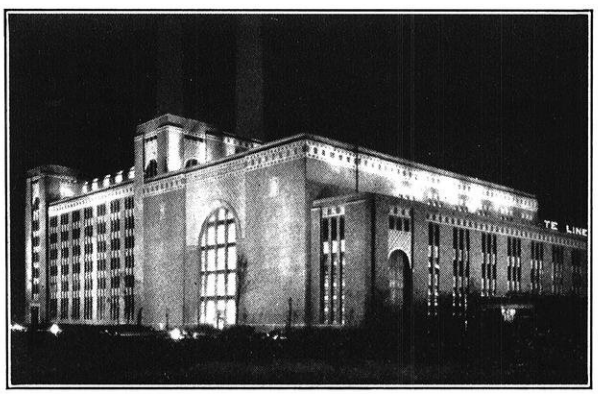
The Wisconsin Engineer

VOLUME 34, NO. 7 APRIL, 1930

State-Line Generating Station

By William H. Teare, e'31

FIFTY YEARS is but a short time in the history of civilization, yet that length of time has witnessed practically all of the development of the commercial applications of electricity as we know them now. It was on October 21, 1879, that Edison invented the first practical incandescent electric lamp, and with the development of Edison's invention came the extension of the power industry, with its increasing demand each year. The first public display of arc lighting had been made a year and a half earlier, when the crude Brush arc lamp was displayed from the old Waterworks Tower in Chicago. Several companies were organized, and public interest was being aroused. But it was not until Edison invented the incandescent lamp that real progress began.



The generating station at night. Unlike most of the industrial plants in the Chicago District, State-Line has been designed well architectually as well as mechanically and electrically.

The first electric company operating under the Edison patents in Chicago was established in December, 1881. It had a small generating plant in the basement of a building in the Loop, and distributed electricity to a few customers in the immediate vicinity. The Chicago Edison Company was organized in April, 1887, marking the real start of the development. The Adams Street generating station began operation in 1880 with eight Edison bipolar dynamos rated at 80 K. W. each. In the next few years plants were built in other parts of Chicago, and by 1892 several companies were operating generating stations in Chicago. Merger plans were carried out whereby all of the operating companies were welded into one strong unit for the generation and distribution of electrical power in the City of Chicago.

The next large generating station was the Harrison Street station which began operation in 1894 with 6400 K. W., and was increased in size until 1902, when it had a rating of 16,200 kilowatts. In its day it was the largest and most important generating station in the counry, but development was so rapid, and the demand increased so greatly that the equipment soon became obsolete. In 1910 it was held as a reserve only, and in 1915 the property was sold and the plant passed out of existance.

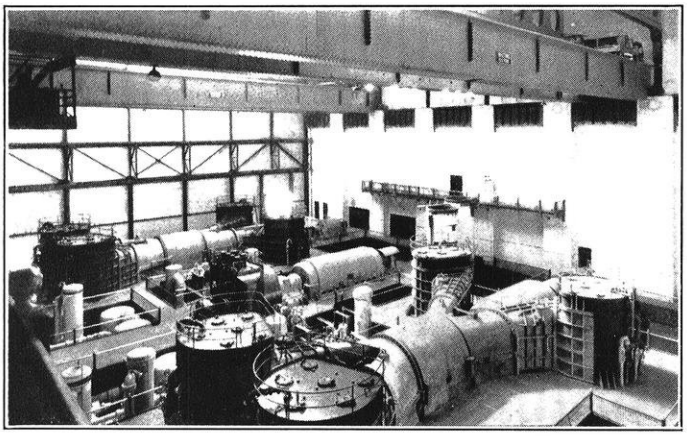
For many years the problem of building steam turbines had been studied, but it was not until 1903 that the first large turbines were installed in Chicago. Two 5,000 kilowatt turbogenerators were ordered from the General Electric Company, and installed in the Fisk Street station. Since that time steam turbines, rather than reciprocating engines, have been used as prime movers in the generation of electric power on a large scale. The development of the turbine was rapid, and the increase in size was great. Inside of six years, the first turbines in the Fisk Street station became obsolete and were replaced. Fisk Street has been increased in capacity until its present rating is 230,000 kilowatts.

Many other generating stations have been built in the Chicago District to take care of the increasing demand. At present, Crawford Avenue station, which began operation in 1925 is the largest, with a capacity of 424,000 kilowatts.

In 1924, plans were laid for the construction of a central station on the shores of Lake Michigan near the Indiana-

Illinois state-line. Permission was granted by the War Department of the United States Government to fill in 73 acres of land which were necessary to prepare the site for the station. The incorporated company is the State-Line Generating Company, and in 1926 the order for the first unit was placed with the General Electric Company. This unit is the largest now in operation in the world; it is rated at 208,000 kilowatts, or 278,820 horsepower. The station will ultimately consist of five units with a probable capacity of at least 1,000,000 kilowatts. The next unit will consist of two turbo-generators, which, when installed and put into operation, will increase the capacity of the station of 483,000 kilowatts. The turbo-generators have been ordered from two manufacturers. One of 150,000 kilowatts capacity at 90 per cent power factor will be built by the General Electric Company, and the other, of 125,000 kilowatts at 85 per cent power factor will be built by the Allis-Chalmers Company.

Just fifty years after the incandescent lamp was invented, State-Line commenced commercial operation. The rapid development of power generation may be made apparent by contrasting the Adams Street station of 1889, 640 kilowatts capacity, with State-Line, 208,000 kilowatts in a single unit. With this unit, State-Line is larger than any other station in the Chicago District, with the exception of the Fisk Street and Crawford Avenue stations.



The turbine room which houses one high pressure and two low pressure turbines.

State-Line Generating Company is owned either directly or through subsidiary corporations by the Commonwealth Edison Company, Public Service Company of Northern Illinois, Northern Indiana Public Service Company, and Interstate Public Service Company. State-Line itself owns no distribution system. The owning companies have contracted for the entire output of the station, and State-Line delivers energy to the owning companies at its property line.

The location of State-Line was selected because there is an adequate supply of cooling water, and because it is in the heart of the Chicago Metropolitan District, which embraces northeastern Illinois and northwestern Indiana. The station is placed on a rectangle of dredged land, about one-half mile long, and one quarter of a mile wide, with three sides fronting on Lake Michigan. It is entirely in the State of Indiana, but one corner touches the Indiana-Illinois line. The building which houses the boilers, turbo-generators, and control room, is 380 by 210 feet, and the switchyard adjoining is 290 by 150 feet.

In the development of power generation, economic operation has been the constant aim; that is, lower investment per kilowatt of capacity and lower operating costs per kilowatt hour of output. State-Line is designed for operation on the most economical basis consistent with reliability of operation, which can be obtained under the conditions existent in the Chicago District.

Unit Number One consists of one high pressure turbine and two low pressure turbines. Steam enters the high pressure turbines at 650 pounds absolute pressure and 730 degrees F., and is exhausted into reheaters at 110 pounds absolute pressure, and about 400 degrees F. In the reheaters this exhaust steam is heated from 400 degrees F. to 500 degrees F. at 110 pounds absolute pressure by means of live steam taken from the high pressure header. The low pressure turbines exhaust into condensers. For the first time in commercial service, five stages of feed-water heating are used, ranging from a maximum of 380 pounds absolute to a minimum of 9.4 pounds absolute.

Each of the low pressure turbines is double flow, arranged so that each set of low pressure wheels is served by two surface condensers, making four condensers for each low pressure turbine, or a total of eight for the unit. The condensers, which have a total of 176,000 square feet of cooling surface are supplied with 380,000 gallons of circulating water per minute, and can condense 1,600,000 pounds of steam per hour. The circulating water is supplied by four vertical circulating pumps placed in the crib-house outside of the boiler house, each of which have a capacity of 95,000 gallons per minute. The water enters the condensers at the bottom, flows upward through the tubes, and is discharged downward through overflow pipes. The temperature of the circulating water is raised about ten degrees in the condensers.

Any one of the three machines may be taken out of service, and operation continued on the other two. The object of this is to provide flexibility of operation which may permit of greater efficiency under varying load. This improvement in efficiency as the load falls off in practice from the ideal point of steam turbine efficiency is due to the improvement in feed-water cycle efficiency as well as to the design of the turbine.

The turbines are supplied with steam at 650 pounds absolute pressure from six boiler units which are designed for 800 pounds pressure. Each unit is equipped with superheaters, economizers, air heaters and water walls, and is capable of supplying 450,000 pounds of steam per hour. Steam extraction feed cycle goes much farther than has been used in the Chicago District; feed-water is heated to 400 degrees F. and the air going into the furnaces is preheated to about 425 degrees F. The boiler units have such reserve capacity that the plant could be operated with five of the six units, and perhaps four, in an emergency.

Pulverized coal is used, and the ash is sluiced by a high pressure water jet from the boiler ash pits to a receiving

(Continued on page 266)

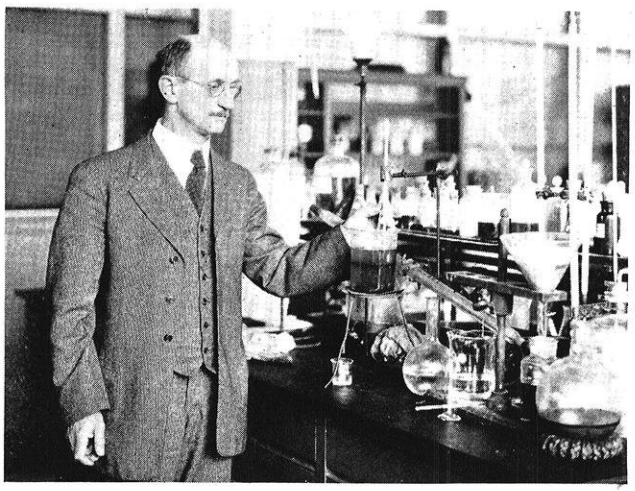
Engineers Chase No Fantasies*

By Prof. Louis Kahlenberg
Department of Chemistry

THE engineering student comes to the university with a clearly defined purpose. He has chosen engineering as his life work and is here to fit himself for it. This settled definiteness of purpose is a distinct asset. By far too many of the students at the university are here with no definite aims, seeking on general principles that rather elusive thing called culture, and hoping that in the course of the four years spent as undergraduates it might dawn upon them as to what they would like to fit themselves for and pursue when college days are over. Lack of definiteness of aim is a distinct handicap wherever it exists. The student who has chosen his life work and chose it with enthusiasm for service has a great advantage over his comrades.

The engineering student has made this choice when he comes. His inherited tendencies, his elementary training and his associations have all contributed to enable him to choose his profession quite clearly. He is an active, bright chap who likes to do things, and so has been attracted to engineering; for an engineer is a man who does things. It is his business to build — to construct highways, bridges, railroads, homes, skyscrapers, ships, submarines, airplanes, telephones, telegraphs, radios, contrivances for heating, lighting and ventilating our buildings, supplying them with water, carrying off and disposing of waste products, getting our food stuffs into shape for consumption and keeping them so, and manufacturing our shoes and clothing. In fact wherever there is anything that we can see, feel, hear, taste or smell is a field for engineering already developed, or a potential one. Engineering is applied science. It is a science in action. Consequently an engineer must be a practical man. His work must yield perfectly tangible, concrete results.

Early interest in machinery, drafting, shop work, surveying, and the like has no doubt been a determining factor with many of our engineering students in choosing their future profession. A boy who enjoys making his own playthings and delights in dissecting and improving the toys that are given him, often selects an engineering career. In other words, a bent toward the practical and mechanical frequently decides in favor of an engineering course, and rightfully so.



Prof. Kahlenberg is well known to engineers at Wisconsin who have vigorously "skyrocketed" at every lecture.

It is consequently perfectly natural to find the engineering student specially interested in shop work, machine design, surveying, drafting and kindred line that are evidently and strikingly practical in their outward character It is far more difficult to interest the engineering student in physics, chemistry, biology, geology, astronomy, and mathematics. Nevertheless, these basal subjects form the very foundation of engineering. A good mechanic or a first class draftsman does not need to know much of the natural sciences; but such a man is not an engineer. A real engineer is a man of creative ability and power; and that ability is in direct proportion to his knowledge of the sciences upon which his profession is founded. Consequently an engineering student who does not pursue the basal sciences with enthusiasm and a desire to master them, to capture their spirit and content and to make them his own, is from the very outset condemning himself to mediocrity as a future engineer. He will be only a good mechanic or draftsman, or at best a helper to a really great engineer.

The pursuit of the basal natural sciences is absolutely essential to the training of the engineer and in performing that work he will obtain a high degree of real culture. His imagination will be challenged and developed by this study, and his natural bent toward the practical and the applied will continually suggest to him new, varied and valuable applications of the sciences he is mastering. It is in this way that really great engineers have developed. Not only have they applied the sciences they have studied to the great benefit of all of us, but they have in the past often made fundamental and exceedingly valuable contributions to the basal sciences themselves. This is as it should be, it is in fact what one would naturally expect.

When our engineering building was completed in 1900, J. B. Johnson, who was dean of the college of engineering at that time, had placed on the outside of the building the names of such scientists as Faraday and Kelvin beside those of Rankine, Siemens, Watt, and Bessemer.

Let the engineering student therefore sharpen his appetite for the basal sciences and not allow the drafting room, the machine shop, and the surveying to occupy all

(Continued on page 266)

*This article was first published in the Daily Cardinal.

An Engineer Explains

The Inadequacy of the Public Utilities Law of Wisconsin

Extracts from a paper presented before the Engineering Society of Wisconsin by PROFESSOR EDWARD BENNETT

THROUGHOUT the length and breadth of the land are to be found magnificent power plants standing unused. These plants are not worn out; many of them could today render service as of old. But they are inadequate to meet the new demands, and they have become obsolete because engineering and managerial vision and initiative have devised and provided less expensive ways and means for attaining the desired ends.

The public utilities responsible for these power plants are regulated in their relations to the public in accordance with legislative acts and laws which antedate the obsolete plants. The question raised in this paper is this: Are the provisions in the laws relating to the regulation of the public utilities which, in the light of the changing conditions and the desired ends, as inadequate or as obsolete as the superseded physical plant?

The principle purposes in regulating public utilities are three in number:

(1) to secure adequate service; (2) to secure reasonable and non-discriminatory charges; (3) to promote financial stability and integrity.

The Wisconsin Utilities Law contains no comprehensive statement of the intent and purpose of regulation, or of the policies and principles to be used in determining the reasonableness of the charges for service. Of the 109 sections contains in the utilities law only six short sections contain any statement having any bearing upon the principles or the policies which are to guide the commission in setting rates. All the other sections (with two exceptions) pertain, not to principles, but to the routine of utility and commission business.

A review of these six sections which contain the substance of all the legislature has said about the principles of public utility rate-making and valuation indicates the source of the difficulty in utility regulation. The legislature empowers the commission to fix just and reasonable rates *but is silent, utterly silent, as to the principles* or the policies which are to be controlling in the determination of reasonableness.

In view of this absence of definitive principle in the law, one is at first amazed that it should have merited the encomiums from the opinions of Justice Marshall. But on further examination it will appear that this very absence of definition is the source both of the early strength of the law during the period of comparatively stable prices and of the weakness of the law during the period of fluctuating prices following the war.

The uncertainty as to the weight which is to be attached to present as compared with original cost of construction is well illustrated by the two decisions delivered by the Supreme Court of Wisconsin in 1923 and 1927 in the case of the Waukesha Gas & Electric Co. vs. the Railroad Commission. In 1923 the Court by affirming the judgment of Circuit Court sustained the Railroad Commission which in valuing the electric property of the Waukesha Company had given controlling weight to "prudent investment costs." The opinion of the Court as delivered by Justice Rosenberry, contains the following statement:

"In determining the present fair value of a public utility operating under our public utility law, it is our view that justice as well as sound economic practice requires that controlling weight should be given in the valuation of the plant of a public utility to the investment cost where the investment has been prudently made. In determining the present fair value of the property of a public utility for rate-making purposes, but little if any weight can be given to capitalization of earnings or to stock and bond values for the reason that these are dependent almost entirely upon the rates charged, the reasonableness of which is the very subject under investigation.

"We shall not attempt to deduce a formula. If, however, we were to accord rank to the various factors in accordance with the weight which is to be given to each in determining present fair value for the purpose of establishing a rate base, it would be as follows: (1) Actual cost of the plant when investment has prudently been made.

THE PUBLIC UTILITY QUESTION

The question of public utilities, already in the spot light of popular scrutiny, is a subject of considerable importance to engineers. No branch of engineering is entirely immune from the effects of proper or improper control over these interests.

This and the two following articles were selected in order to give a well rounded approach to the topic.

Prof. Bennett has prepared an extensive and well developed paper from which this short extract was taken. In his paper, Prof. Bennett suggests the wording of specific statutes by which the prudent investment principle of valuation may be enacted into law. Reprints of his paper are available to those who are concerned with the problem.

The economic viewpoint, presented by Francis Staten who has just submitted his doctor's thesis in economics, treats the situation as an experiment which is yet to be completed.

For the third part, the railroad commission of Wisconsin has expressed the principles which have been fundamental in its past policy.

(2) Under normal conditions, cost of reproduction new less depreciation. (When conditions are abnormal, cost of reproduction new less depreciation should be fourth). (3) Going-concern value. (4) Working capital. (5) Other elements of value which may be represented in a particular case." 181 Wis. 281.

On any appeal in 1926 by the same company in an action to test the reasonableness of gas rates fixed by the Commission at about the same time as the electric rates and using he same methods, the Supreme Court receded from the position taken in the previous case, reversed the judgment of the lower court and set aside the order of the Commission as unreasonable and confiscatory. The opinion of the Court as delivered by Justice Vinje contains this statement:

"In the McCardle Case a valuation made substantially like that of the Commission in the present case was set aside by the court because, in view of the great advance in prices during and after the war, it did not correctly reflect the actual value of the property as of the time the valuation is made, which is the date of the order fixing the rate and the probable value for some years to come. A valuation which does not as to the tangible property substantially reflect the then cost of reproduction less depreciation does not meet the requirements." 191 Wis. 565 Jan. 1927.

The indefiniteness as to the principles of rate-making gives rise to the following situation. When land has appreciated in value and costs of construction are above the normal, the utility managements contend that the preponderating factor in determining the value of the property for rate-making purposes should be the estimated cost of acquiring the land and constructing the plant at the prices prevailing at the time the plant is revalued: in other words, that the preponderating factor should be the "cost of reproduction new, less depreciation." On the other hand, the advocates of the public contend that the preponderation first should be the original "prudent investment" in the property. When the costs of construction are below the normal, the two parties to the controversy reverse their positions, and each now contends for the principles of valuation which it formerly repudiated.

If we may call an action in which one reverses his position for the sake of personal gain, — renouncing principles formerly held and embracing principles formerly denounced, — an unprincipled action, then we may say that the dearth of definite principle in the acts of the legislature and the decisions of the courts is conducive to unprincipled and stultifying controversies. This state of affairs cannot long be tolerated because of the dangers and wastes with which it is attended; wastes such as, —

(a) The direct waste entailed in the litigation and costly valuations carried on to establish advantageous rate bases during and after periods of changing prices.

(b) The indirect wastes which result from the effect of needless litigation in lowering the moral of the operating organization and antagonizing the supporting public.

(c) The indirect wastes which result when the activities of the administrative and engineering staffs are diverted by needless litigation from their normal constructive work.

(d) The inefficiencies which result from absentee landlordism and absentee engineering in consolidations which are brought about not to effect engineering economies, — but because of opportunities for private speculative profit under a fluctuating rate base.

But more serious than these direct economic wastes is the lowering of the tone of social endeavor and of the standards of individual, professional, and civic integrity which results from stultifying controversies.

This leads us to formulate a comprehensive statement of the principles of valuation and rate-making evolved by the Railroad Commission, and to discuss the reasonableness of the principles and the possibility of embodying them in the law.

The Railroad Commission of Wisconsin, the regulatory commissions of the other states, and the Interstate Commerce Commissions are substantially unanimous in their finding that in any workable scheme of valuing properties

The trend of this curve shows the impossibility of basing valuation on original cost alone. Prices trebled from 1895 to 1920.

for rate-making purposes, preponderating weight must be given to the actual cost of the property when the investment has been honestly and prudently made.

It seems fairly clear that the problem in the regulation of the public utilities is a problem which lies at the door of the legislature. Stating this problem in general and yet in specific terms, it is the problem of effectively embodying in the law, particularly in the stipulations relating to the granting of the indeterminate permit, the statement that public interest and necessity require the adoption of the principle that land, structures and equipment purchased or acquired by a public utility for the services of the public are thereby dedicated to the service of the public and are held in trust for the public, and that a fair annual return to the investors in the utility shall be deemed to be such an annual return on the money honestly and prudently invested as to command all the capital needed in the enterprise.

An Economist Discusses

Public Utility Control: An Experiment

By FRANCIS A. STATEN
Department of Economics

ANY discussion of public utility regulation gains in perspective if we approach it from the viewpoint of those legislators and economists who initiated it more than two decades ago. These men were faced with the problem of finding a satisfactory remedy for ineffective control of local utilities by means of term franchises. Financial manipulation with its consequent overcapitalization was reacting on the consumer through high and discriminatory rates and poor service.

Two possible solutions presented themselves at the time: Regulation by the State or by local bodies, and public ownership. Conservative opinion preferred regulation as against ownership which was referred to as "a dangerous and uncharted way". Regulation was hailed by both sides as the solution. The experimental nature of regulation was recognized, however, in that a provision was made that municipalities might at any time purchase the property of a utility company operating under an indeterminate permit by paying therefor its fair value as fixed by the Railroad Commission. This was to be the way out in case regulation failed.

Since the utility law was drafted two important developments have intervened to markedly change the facts anticipated by the draughtsmen. The first of these has been the expansion of the market for utility services to include more than one municipality. The effect of this expansion on the availability of the municipal ownership alternative is obvious. Public ownership to be economically advantageous after this, could be promoted only by cities of substantial size or by combinations of municipalities. To sever one section from a superpower system usually is adverse in its effect on the efficiencies of both the large system and the new segregated unit.

While the superpower development, together with fairly effective regulation in the earlier years, has practically given the Wisconsin market to private ownership, the public ownership threat has been perpetuated by public developments in other sections of America. Noteworthy instances are the Ontario hydro-electric development, the Los Angeles Power Bureau, and the Seattle and Tacoma municipal light and power systems. Hence, while experimentation in Wisconsin has been confined largely to regulation, elsewhere other experiments have been carried on and the American prejudice against government in business has received some rude jolts by the results. It appears that a public body can, when necessary, perform essential functions for its citizens, and do it effectively.

The second important development unforseen by the draughtsmen and by the best informed minds of that time has been the nullification of the working rules of regulatory Commissions by the courts. The effect of the judicial procedure, with its slow process of inclusion and exclusion, has been that nothing is ever settled. For more than twenty years controversy has continued about the valuation problem which is only one aspect of regulation. Valuation, while important in itself, has so occupied the time and effort of administrative officials as to crowd out almost completely other very important problems.

While the valuation controversy goes on, the utility business does not wait for a settlement. It is organized for action and does act. Regulation must be dynamic to keep up with a dynamic industry. It must know what it is about because uncertainty is always resolved in favor of the side which is in a position to strike first. The most serious result of court interference with regulatory Commissions has been that an atmosphere of futility has been engendered. The most serious effect is the psychological one.

Private ownership of public utilities with regulation is still in the experimental stage. It has to become a proved method of providing utility services to the consumer. It is entirely possible that under our present constitutional law that we will not be able to work out a feasible system of regulation. It may be that restraining orders based on antiquated legal notions of property rights will always come in to such an extent as to continually hamstring regulation.

Moreover, the nature of the industry is such that a continuous intimate local contact with each public utility will be essential to proper control. Whether such contact can be established is still a question. One thing more than all else is apparent from the experience of the last two decades. Regulation cannot be effective if it depends on the evidence submitted by utilities. Continuous audits are essential, and even then it is a question whether the lags in control will not be such as to make public ownership necessary. Regulation cannot be retroactive or remedial in practice. What it cannot prevent it can do little about except in theory. The question is, then, can regulation be flexible enough and active enough to prevent abuses? If not, then it cannot succeed.

We may say that we are now observing two experiments, one in regulation, and one in ownership. The disinter-

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A State Body Interprets

Public Utility Valuation--Reasons for Investment Basis

Prepared on Behalf of
Railroad Commission of Wisconsin

IN discussing the cost of reproduction as a basis of valuation of public utility properties in the Duluth Street Railway Company case (RCR May 1923), the Commission said:

> "We are not commanded by the courts ****** to give either sole or preponderating weight to the cost of reproduction; neither do we understand ***** we are restricted to the prices prevailing at the actual date of inquiry, but that we may deal rather with the general levels of prcies over a period substantially similar to that of the date of inquiry."

While the Commission has always recognized reproduction cost at current price levels as an element to be given substantial weight, it has not believed that it should be the controlling factor, and at the time of the decision in the case above cited it did not interpret court decisions as requiring that it be given primary weight. However, from the court decisions made since 1923, such as that in the Indianapolis water case, it appears that the policy of the Commission must be modified.

Notwithstanding such decisions, there are fundamental objections to a valuation policy based solely or primarily on current cost of reproduction. In a normal market a persuasive evidence of market value of the plant and business in competitive industries is the selling price of the securities. During and immediately following the war the prices of many securities declined very sharply. The change in interest rates brought about a shrinkage in bond prices, in many cases from 10% to 25%. Preferred stock issues and even common stocks were similarly affected. Yet this period was one of increasing prices for labor and materials. These facts well illustrate an important factor to be considered in this problem of reproduction cost: namely, that when the cost of replacing the property of a business is increasing, the value of the plant and business, or what may be called the going value, may actually be decreasing.

It is probably true that, in part because of rate regulation, utility securities have not had the same fluctuation that we find in competitive industries, and that it is not satisfactory to compare utilities with other businesses where there is greater freedom of purchase and sale in the open market and where the extremes of the fluctuations of market value are wider. Let us assume, however, that at a time when the replacement cost has increased very materially over the investment, the market value has increased also. What is the effect of such an increase upon security holders and customers?

The public utility business is conducted largely on borrowed money, often to the extent of 60% to 70% of the investment in the property. In addition, there is often a substantial amount of preferred stock, the return on which is limited to the amount fixed in the certificates. Yet, the bondholders and the preferred stockholders who furnish the major portion of the capital get no benefit from any increase in value — the benefit accruing to the holders of the common stock who have furnished only a small portion of the capital.

Assume that a utility is financed to the extent of 60% by bonds, 20% by preferred stock, and 20% by common stock, and that subsequent to the date of investment, the replacement cost has increased 80%. Those investors who have furnished 80% of the capital would derive no benefit, whereas the common stockholder would find his equity multiplied by five. Conversely, if the cost of reproduction has decreased 20% from the actual investment, the equity would be entirely wiped out.

The effect of giving primary weight to reproduction cost is to make the common stockholder's position that of a speculator, interested, not in a normal return, but in the possibility of speculative gains, which must be large because of the possibility also of large losses. On the other hand, if the investor knows that material weight is to be given to actual investment, reasonably and prudently made, and less importance assigned to reproduction cost, he has, to that extent, an assurance that speculation is to be eliminated, and the assurance that his return, though not likely to be as great as the possible return in a speculative business, is almost certain to be more secure.

What of the customer? If values are to fluctuate with changes in reproduction cost, the obvious effect during a period of increasing prices will be that the customer must pay a return on a high valuation. Nor does it appear certain that the customer will get the benefit during period of declining prices. The decrease in the value of a public utility property, below the investment reasonably and prudently made, will weaken or destroy its stability, and the rate of return which must be provided to attract capital must be increased.

The stability of any business is dependent upon the free flow of needed capital into that business. Free flow of capital, in turn, depends upon the attractiveness of the rate of return. As long as the rate of return makes the business attractive to capital, that return is not unreasonably low; conversely, a rate which is not attractive to capital will certainly restrict its flow into the business and hamper its development. If upon reasonable, legitimate and prudent investment the utility is allowed to earn what-

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The Nicaraguan Canal Project is Revived

By FRANK J. CUMMINS, c'30

THE Nicaraguan Canal project, once a formidable rival of the Panama Canal project, is again in the limelight, after many years of quietude. On September 5, 1929, an engineering battalion of 400 officers and men was ordered to duty by the American secretary of war to resurvey the route. During the past winter, which is the dry season in Central America, the surveys have been progressing under Major Dan I. Sultan. Nicaraguans are reported to be enthusiastic over the prospect of action. The immediate cause of the congressional action that led to the present survey was the report that the Panama Canal is rapidly approaching the limit of its capacity. The question is whether to enlarge the Panama Canal or build a new canal at Nicaragua. The United States already has an agreement with Nicaragua that will permit it to construct such a canal.

U. S. Engineers now making a survey for the proposed Nicaraguan Canal, are also making surveys for a railway from Lake Nicaraguan to the Atlantic at the request of the Nicaraguan government.

The first engineering survey at the site of the proposed Nicaraguan Canal was made in 1850-52 by Col. O. M. Childs, who was employed by the Transit Company which controlled most of the trade in that territory. Col. Childs, an able engineer, proposed a waterway with a ruling depth of 17 feet.

In 1872 the U. S. Government sent Commander Lull with a party to examine the site still further and see if it were feasible. In December, 1873, he presented his report and recommended that Child's plan be enlarged and a ruling depth of 26 feet be established. A G. Menocal, a member of the Lull party, revisited the area in 1880 and again in 1885 and enlarged on the plan each time. In 1885 he made his report, and a concession was obtained from the government of Nicaragua for the construction of a canal within its territory. The concession provided that the plans be deposited and work begun within a period of two and one-half years from the time of granting of the permission. Thus the Nicaraguan Canal Construction Company was formed, money was raised, and plans were made to begin work on the canal.

In 1889 the Maritime Canal Company was formed and took the concession, but permitted the Nicaraguan Canal Company to continue with its work. In 1893 the Construction Company was liquidated. It was a panic year; the financial situation was bad and money was hard to obtain. Part of the channel had been dredged and approximately one thousand feet of pier work completed. A few miles of single-track railroad and some telephone lines had been constructed. This is the total of all the work that has been done upon the project.

In March, 1895, Congress voted for another investigation to determine the feasibility of the project, the cost, and the permanence. The committee consisted of Lt. Col. Wm. Ludlow, C. E. Mordecai Endicott, U. S. N., and Alfred Noble. The report of this committee is limited to a few copies and these, unfortunately, are not available to private citizens.

The project was to include the improvement of Greytown Harbor. From this point the canal was to go westward at sea-level to the eastern divide, the crossing of which was effected by three locks, and by an enormous cut 3.15 miles long and 324 feet deep. Emerging from this divide, the route traversed a series of deep basins which were to be confined by dams and joined through intervening ridges. At the end of this, the canal was to emerge into the San Juan River, which is far below the proposed summit level. The Ochoa dam would raise the surface of the river over a distance of fourteen miles. Then the course would follow the valley of the Lajas River to the western divide, which is crossed by a 74-foot cut, and then continue down the valley of the Rio Grande to the ocean at Brito. In so doing, crossing torrential Tola could be avoided by the construction of the La Flor dam.

The rainfall records at Greytown for the years 1890, 1891, and 1892 showed a mean of 267 inches, a maximum of 297 inches and a minimum of 214 inches. This precipitation was nearly four times that of the rainy belt in the

United States. The proposed 324-foot cut could be maintained only by having it in the hardest of rock. In making the survey little study was made of the floods in the rivers.

M. Brunau Varilla, chief engineer of the Panama Canal prior to the time the United States took over the project, brings to our attention one serious obstacle in the way of the construction of the Nicaraguan Canal, which is 184 miles long across the Isthmus of Nicaragua. If this project were carried out, it would be within a region affected by continual earthquakes. Panama Canal was constructed because it was free from this objection. This was the only factor which caused the Panama Canal to be built in preference to the Nicaraguan Canal. Since the U. S. took over the Panama Canal nearly 20 years ago there have been only a few slight tremors.

On the contrary, at Nicaragua there are three large volcanoes which would hinder the engineering work as well as to menace the lives of all the men working in the vicinity. Brunau Varilla says, "The advocates of the canal forget that, with the huge dams and locks necessary, all made of stiff material, it is almost crazy to trust such a gigantic rigid piece of engineering to the volcanic and continually vibrating soil of Nicaragua. Some thousands of U. S. Marines kept down the upheavals of the political volcanoes in Nicaragua. All the forces of the United States, all her gold, all her technical genius will not prevent Momotombo, the Masoya, the Omofrom and their many brothers from spouting flames and ashes, and their gigantic eruptions from shaking to earth the dams and locks which engineers, lacking observation and foresight, may be led to erect at their base."

Brunau's plan was to cut down the Panama Canal to sea level and eliminate all locks. This procedure would provide an unobstructed waterway from ocean to ocean However, there is a difference of 20 feet in the tides (2 feet rise and fall at the Atlantic end and 22 feet at the Pacific). A lock would be necessary to prevent a strong current through the waterway. He would make the canal

The proposed Nicaraguan Canal, 183.7 miles long, will shorten the distance between our Atlantic and Pacific ports by 700 miles.

1000 ft. wide. No doubt his ambitious scheme could be completed. However, nature would take charge at Culebra, and instead of slopes of 1½ to 1 there would result slopes of 7 to 1, or the natural angle of repose.

In the years 1927 and 1928 the United States was engaged in a serious political controversy in Nicaragua. Few Americans realized all that was involved in this struggle. One reason why the United States sent marines to Nicaragua was because the country realized that Nicaragua owns the only route which can be used in competition to the Panama Canal. Years before the Panama Canal was built, the Nicaraguan route was considered as the most acceptable one. Each commission sent to Central America by our government favored the Nicaraguan route over the Panama route. There were four possible routes available, and the Nicaraguan route ranked first and the Panama route third. The Nicaraguan route was favored because it is shorter by 700 miles between New York and San Francisco, approximately three days' sailing. The climate is superior. Lake Nicaragua, 120 miles long by fifty miles wide, is in the line of the canal and would insure a plentiful supply of water for feeding the canal. The highest estimate on the cost of the Nicaraguan Canal is $250,000,000 as compared to $412,000,000 which was spent in Panama.

The United States was blocked in its attempt to make a treaty with Nicaragua. The country was ruled by a dictator, Zeleya, and he stopped every attempt which the United States made. In 1912 when a rebellion broke out in the country and when marines were sent there Zeleya was forced into exile. Adolpho Diaz then became president and he immediately signed the treaty which Zeleya had rejected. Under the treaty the United States bought the privilege of constructing a canal across the country. The cost of this treaty was $3,000,000. Included in this agreement was a clause providing for an exclusive right to a naval base on the Pacific Coast. Nicaragua's sister countries have objected to her granting to a foreign country the right to control a coast line which belongs as much to them as to Nicaragua. Therefore, the neighboring countries have opposed the canal project on this basis.

Since 1916 Nicaragua has enjoyed a prosperity beyond any previous experience. Railroads have been built and highways have flourished. Therefore, there is every reason to believe that the country will cooperate with the United States in an effort to complete the project.

The other hand the United States realizes the necessity of keeping this territory under its control. The United States, by keeping its naval base on the Pacific Ocean, can insure its safety, and that of the Central American countries from any hostile foreign countries.

The traffic through the Panama Canal has more than doubled the estimate made about fourteen years ago for this time. It will probably reach its maxium in ten years more, so it is none too soon to begin to plan for a new route across the Isthmus. Ten years were required to complete the Panama Canal, so it can be readily seen that it is time to begin work on the project.

The construction of the second canal is regarded as necessary from a military standpoint. If the locks at Panama were destroyed in war, our ships would be obliged to go around the southern coast of South America. A second canal at sea-level would relieve the situation, and in case of war one canal could be closed to all commerce, and the other maintained for the benefit of neutral countries. Enlargement of the Panama Canal would cost only one-fourth of the amount required to construct a new one, but the military aspect enters into the question. The Nicaraguan route is far better than the Panama from a standpoint of defense.

Editorials

FAME There is something fascinating about a man who rises to fame and success. It is not a promoted thrill brought by the cinema, or the magazines. Horatio Alger had nothing to do with it. It is the same thrill that you experience when you watch a horse race, and see an apparent loser swing around the last corner, spurt down along the home stretch, and take the purse from the favorite. And horse racing is older than literature or the movies.

No, it is a feeling that is a part of the heart. It holds its spell like the charm of a hearth fire. It is fundamental in man's being. In every nation, you will find the light of popularity overwhelmingly shed on those who have overcome obstacles to reach the wreath of laurels.

List, if you will, the names of men you know to be famous. Examine the life of each one, noting especially the early beginning. It is surprising to see how many began as almost nothing. It is thrilling to see how many began as almost nothing.

A ducal feast is being prepared. A careless servant drops the ornate piece of sculptory which is to be placed at the center of the table. A poor servant lad carves a magnificent lion out of a huge brick of butter. Hundreds of years later we pause, in the Louvre, before an exquisite marble carved by the same hand, and we are thrilled, by Michel Angelo.

A gaunt rail splitter spends his boyhood days in the wilderness of early America. He works in the day time with the chores and at night with the books before the fireplace. He does not receive a college education. Seventy years later we read the president's speech commemorating a battle field and are thrilled.

An Englishman raised as one of a family of six whose only support was a colliery engine tender's salary studied at night and mended shoes and cleaned watches in the day time. Later George Stephenson became the leading railway man of England and one of the world's greatest engineers.

It is always an old story. A humble beginning, the struggle to exist, perseverence, and finally success, fame and the spot light. It may cover volumes. It may be complete in a hundred words. We may read about it, hear it told, or actually see it for ourselves, but whatever the means of expressing it may be, we are thrilled by it.

ST. PAT'S PARADE The ancient and solemn ceremony in memory of the revered St. Patrick is gone. It remains to only a few of us in tender recollections and will soon enter the oblivion of the banished. Condemned by the powerful hand of Polygon, supported by none of the other outstanding bodies, the parade of the patron saint of Engineers will probably never again appear on the streets of Madison.

This recent *coup d' etat* calls to our minds the successes and failures of the notable event in past years. Among those of importance was the egg throwing brawl instigated by none other than the cane-bearing shysters. Eggs flew. Aromas arose. Many suits were ruined. State Street lay in a shameful state of putrescence. And St. Patrick turned over in his grave.

Since then the parade has been recognized as only a bad habit which it was the duty of every engineer to indulge in once a year. Its popularity waned. Its objectionableness increased. Last year's event was a meaningless and simple demonstration which cluttered up Langdon Street. It was an effort to watch the affair to say nothing of taking part in it. The St. Patrick's parade is gone.

Polygon, not content with ruling away one of the engineers' bad habits, instigated the selling of green feathers. Polygon is a constructive organization. Strong arms which last year wielded ferocious looking weapons in defense of the wordly representative of the famous saint, meekly held out a nickel and became decorated with a green feather. Why a feather was used has been kept a secret. St. Pat was a wise bird.

THE CIVILS INSPECT

Sixty bright (?) and eager (?) faces gathered around the civil mentors in the Chicago Northwestern station a week ago Monday morning to answer the first roll call of the inspection trip. Chicagoans, whose curiosity was aroused by the large group, stopped to "rubberneck". Prof. Withey dispelled all wild ideas from the timid station policeman who was finally convinced that this was not an I. W. W. convention, a race riot, or the army of the unemployed.

The city as usual supplied two tugs to carry the group up and down the river from Michigan Avenue to Halsted Street. The afternoon was spent at one of the largest terra cotta factories in the world. No one on the trip will argue this point.

The Illinois Steel Plant was the scene of the second day of the ordeal. Cameras were confiscated. Police guides, usually tickled to find an appreciative audience, enthusiastically proclaimed the thirty-six inch rolling mill to roll fifty-two inch sections.

An afternoon at the cement mill, an early start the next morning to the Gary steel plant, and an afternoon at the Gary tube mill completed the trip.

Wohlgemuth, anticipating a race last week end, left the party in a badly overtrained condition. Trieloff continued the inspection trip to Topeka, Kansas.

Where did the funds obtained from the sale of St. Patrick Day Tokens go? The faculty sponsor of the *Wisconsin Engineer* threatened black mail but was only able to get a small portion.

It is rumored that Triangle will hold a beer picnic this spring to give vent to the emotions which now have no outlet (engineers invited). St. Patrick parade is gone

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SOMETHING EXECUTIVES SHOULD UNDERSTAND

Many brilliant, technically-trained men fail to attain chief executive rank because they concentrate so exclusively on engineering and similar problems that they neglect the study of the human equation. They become masters at handling machinery,tools, materials, etc., but they do not become masters at handling men. Nor are engineers the only class guilty of underrating the growing importance of humanics.

A successful engineer has said, "One fact must never be forgotten. This is, that the world of finance, while seeking the aid of the trained engineer, is looking for more than engineering knowledge, however profound. The men called to leadership in business and finance must have far more than technical equipment. They must have an appreciation of the springs of action of men and the power to direct and inspire them. The relations and interactions of men are a thousand times more complex than those of materials.

"This is strikingly exemplified among the large engineering and construction concerns of the country. Without proper administration and finance, these institutions cannot be successful. It follows that they must have capable business and financial leadership. Many of these posts are now filled by engineers. Where the engineering talent possessed of other requisites is available to fill these positions they should be so filled. But between a high-grade technical engineer without executive and business ability, and a high-grade executive without technical ability, the choice of an administrator, even for an engineering or construction organization, should fall to the latter."

When a position of monumental importance is to be filled, what qualities do boards of directors look for? The first test they apply to a man is, Has he the necessary ability? The second is, Does he know how to inspire loyalty and to handle men successfully?

BACK COPIES OF THE ENGINEER

The *Wisconsin Engineer* has on hand many back copies of the magazine. There are representatives from almost every one of the thirty-four volumes which have been published during the lifetime of the *Wisconsin Engineer.*

These sets of issues are of considerable value to anyone interested in the past of the engineering college. Alumni might be attracted to the idea of obtaining the entire set of four volumes that was published during their undergraduate days. Contributors to the *Wisconsin Engineer* might be glad to take advantage of this opportunity. For this reason, the business manager will dispose of all obsolete numbers which are available. Get in touch with him if you are interested. Come early and avoid the rush.

THIS "BADGER" BUSINESS

Yes, we got "sucked under" this year — we hope for the last time. We refer to our craven submission to the high-pressure salesmanship of this year's *Badger* staff which induced us, in a moment of mental aberration and financial indiscretion, to sign a contract for one of the cleverly hidden pages in the back of their book, adjacent to the advertising section, for the princely sum of 40 dollars.

But there are three organizations in the engineering college who had what George Little calls "red guts" enough to stand on their hind legs and refuse to contribute to raccoon coats for this year's Badger editorial and business staff. We refer to A. S. M. E., Alpha Tau Sigma and A. S. C. E., who have wisely decided to keep their pictures from gracing those pages of this year's *Badger* that nobody else wants.

The loss, for it is to all intents and purposes a dead loss, of forty bucks will not endanger the prospects of this magazine's appearance on the campus during the remainder of the year — and we can list the cost of the *Badger* page under the heading of "contributions" in our income tax statement, without fear of question. But there are organizations in this college who cannot stand the financial drain of such an exhorbitant tax for so little a service. We refer this time to Polygon, Pi Tau Sigma, Chi Epsilon, Tau Beta Pi and Eta Kappa Nu, every one of which is draining its treasury and crippling further activities this year, merely to maintain ridiculous precedent.

The editors of this magazine know, as well as do those operating the *Badger,* that the increases in the cost of *Badger* pages during the last several years are not in any way commensurate with changes in the cost of printing, binding, engraving, or so-called "art" work. We believe that a comparison of the actual costs for these services during the respective years will fail to justify the exhorbitant demands made upon college activities at Wisconsin for material which such a publication should be glad to have.

Instead of the advertising and subscription list carrying the cost of the *Badger,* as should be the case, the cost is being transferred to those whose natural desire is to see their organization represented in a book which purports to present a cross-section of Wisconsin life. But the organizations are not dealing with a publication whose main object is to present our student life as it is; they are dealing with a group of men who are in the work for all they, personally, can get out of it and who are engaged in exploiting every branch of intellectual student achievement and activity which will submit.

Well, we lost the forty and we suppose this piece of our mind has earned us a position in the high disregard of the high moguls of Badgerdom. If you will search carefully among the advertisements of plumbing shops, restaurants, and shoe-shine parlors, in the last few pages of the 1930 *Badger,* you may find our ashamed faces smiling forth at you — look well, it will be our last appearance!

(Continued on page 262)

Alumni Notes

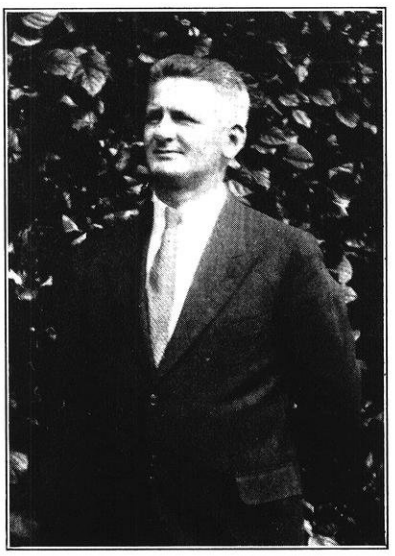
Successful Wisconsin Engineers

Joseph F. Kunesh

By ROBERT L. VAN HAGAN, c'32

The city of Honolulu is facing a serious situation in regard to its water supply; the head in its artesian wells is dropping and salt water from the ocean which surrounds the small island is encroaching to a menacing degree. This modern city of 100,000 people faces the prospect of being without an adequate supply of fresh water. Engineers have been studying the situation, which, unfortunately, has become involved in politics. The issue is whether the territorial government or the city itself shall have control of the city's water works, and the matter is in the hands of the Territorial Supreme Court. While this point is being thrashed out by the legal luminaries, the engineers are making every effort to avert, if possible, the hydrologic catastrophe. Active in this interesting situation is a Wisconsin Engineer, Joseph Francis Kunesh, '14, who is the author of two volumes of reports that have recently been published by the Honolulu Sewer and Water Commission.

Joseph Kunesh was born in Stangelville, Wisconsin, June 16, 1890, son of John P. Kunesh, a farmer. He was graduated from the Kewaunee high school. While at the university he was a member of Triangle, the Bohemian Club, and C. S. A. He was also a member of the sophomore Class Pipe Committee. He was graduated from the course in civil engineering in 1914. While he was in college he worked one summer as draftsman for the Wisconsin Highway Commission and one summer on the engineer corps of the C. & E. I. Ry. After graduation he went to Plainview, Texas, as engineer-in-charge for the Texas Land and Development Co. and stayed there a little over a year. Then followed a year, 1915-16, as assistant irrigation engineer for the U. S. Department of Agriculture at Billings, Montana, and Mercedes, Texas. Four years, 1916-20, were spent with the U. S. Geological Survey, at San Francisco, California, and Tucson, Arizona, during



Joseph F. Kunesh

which time, Kunesh passed through the grades of junior, assistant, and associate engineer. Two years, from 1920 to 1922 were spent as resident engineer with Layne & Bowler Company at Memphis, Tennessee, and New York City.

In 1922 an important opportunity was presented to Mr. Kunesh; he was appointed chief hydrographic engineer for the Republic of Haiti, under the auspicies of that republic together with the U. S. Geological Survey and the U. S. Navy. During his two years on the island he organized the Hydrographic Division of the Department of Public Works and was the author of the first *Annual Water Supply Papers*, written in French and in the metric system.

After his return to this country he spent a short time as designer with the Board of Transportation of New York City and then a year, 1925-26, as water supply engineer for the Florida East Coast Ry. This was during the great Florida Boom, against which even his engineering training was not proof. He still has some real estate as a souvenir. Following this he spent short periods with the Department of W. S. G. & E. of New York City and with the New Jersey Transit Commission. In 1927 he went to Honolulu as hydraulic engineer under the joint auspices of the U. S. Geological Survey and the Honolulu Sewer and Water Commission. The reports that he has produced in connection with this work are of a high order of excellence and mark him as an out-standing figure in the field.

Mr. Kunesh was married on April 12, 1921, to Anne Elizabeth Cabalek, a graduate of the University of Illinois. There are two sons, Robert Joseph and Donald Francis.

During his eventful career, Mr. Kunesh has found interest in languages and has mastered eight. He has also developed considerable artistic talent which he is able to use to advantage in illustrating his reports. He has studied public speaking under Judge Huber of Honolulu. Astronomy is another field in which his work and his natural inclinations have combined to interest him. Golf and tennis furnish him sport. He is an associate member of the American Society of Civil Engineers.

CIVILS

The following civil engineers completed their course in February and have taken positions as indicated: **James W. Arnold** will probably be with the U. S. Engineers at Milwaukee; **Herbert C. Grupp** is with the Henkel Construction Company of Mason City, Iowa; **Vernon Hamel** is taking the law course at Wisconsin; **Marcus B. Hunder** is research assistant in the department of Mechanics at Wisconsin; **Clayton F. Paschen** is with the Paschen Construction Company of Chicago and is residing at 5622 Sheridan Road, Chicago; **Roger W. Stevens** will probably be with a construction company in West Virginia; **Bernardo Cock Velasquez** is returning to Columbia, his home country, where he will be in business with his father, an engineer.

Binish, Stanley, c'29, is with the U. S. Army Engineers in Milwaukee in charge of harbor surveys on the lake boat Manitowoc. He expects to spend the next three months making hydrographic surveys on the Great Lakes.

Blanchar, John E., c'29, is with the U. S. Engineers at Milwaukee.

Breuer, O. W., ex-c'22, who is president of the Bahr Construction Company of Manitowoc, was recently married. Mr. Breuer sas been given the contract for sewer installation at Middleton.

Conrad, Cuthbert T., c'15, CE'16, is expected to return to Madison soon from San Paulo, Brazil. Mr. Conrad was formerly with Mead and Seastone of Madison.

Fischer, Frank A., c'29, who went to work with the Wisconsin & Michigan Power Co. after graduation, is now with the U. S. Engineers at Milwaukee.

King, Max W., c'09, is with the J. G. White Engineering Corporation of New York.

Kuenzli, Daniel, c'29, is with the S. M. Siesel Co. working on the new County Court House in Milwaukee. Address: 151 Warren Ave., Wauwatosa, Wisconsin.

Lane, E. Neil W., c'20, has taken a position in the maintenance division of the Chicago & Eastern Illinois Ry. at Salem, Ill.

Lidicker, William J., c'28, was around the University looking for surveyors to survey the State of Missouri for water power. He is with the Management and Engineering Corporation, a subsidy of the Utilities Power and Light Corporation. Address: Bank and Insurance Bldg., Dubuque, Iowa.

Mackie, James E., c'23, gave a lecture to the engineers on March 21, at the engineering college, on the "Correct Uses of Lumber in Construction". Mr. Mackie is structural engineer for the National Lumber Manufacturers Ass'n.

Markwardt, L. J., c'12, CE'22, is the author of a pamphlet on "Comparative Strength Properties of Woods Grown in the United States," which is being published as Technical Bulletin 158 of the U. S. Department of Agriculture. Mr. Markwardt is in charge of the section of Timber Mechanics at the Forest Products Laboratory at Madison, Wisconsin. The new bulletin presents in popular form information on the strength, weight, and shrinkage of 164 native species of wood, based on over a quarter of a million tests. It will be sent free to those requesting it as long as the supply lasts.

Preston, Burt K., c'26, is now with the Illinois Department of Highways assigned to the Elgin office. He is living at 1624 Ashland Avenue, Des Plaines, Ill.

Stevens, Roger W., c'30, completed his undergraduate work in February and is working for a firm of constructing engineers in Wheeling, W. Ba., and living at the Y. M. C. A. He is learning to scale quantities from blue prints preparatory to applying prices. "Try it and see how much you can leave out," he writes. "These boys want exact figures because the competition is keen."

Van Akren, Ivar G., c'29, has left the staff of the State Board of Health and is with the U. S. Engineers at Milwaukee.

Villatuya, Roberto P., c'23, is with the Irrigation Division, Bureau of Public Works, Manila, P. I.

ELECTRICALS

Bagnall, Vernon B., e'27, is doing transmission engineering on radiotelephone circuits with the A. T. & T. Company of New York. Address: 15 Dey Street, New York City.

Carlson, McKinley S., e'25, address: 230 South Clark Street, Chicago, Ill.

Cotter, Sylvester D., e'28, has changed from the Lansing office of the Bell Telephone Company to the New York office of the same company.

Ford, Arthur Hillyer, e'95, professor of electrical engineering at the University of Iowa, is reported to have died recently. He was the author of several textbooks on electrical engineering.

Melcher, Harvey R., e'25, address: 49 — 6th Ave., La Grange, Illinois.

West, Kenneth A., e'24, is in the television section of the advance development division of RCA-Victor Corporation at Camden. Address: 4723 LaFayette Ave., Merchantville, N. J.

MINERS

Best, Byron G., ex-Min'13, writes from Ironwood, Mich., where he is employed by the Oliver Iron Mining Co., as follows: "A few nights ago we had a semi-reunion of the old gang: **Charlie Alaniva,** Grand Rapids, Mich., **Howard Eidemiller,** Ramsay, Mich., **Barney Knudsen,** Iron River, Mich., and myself. Although three of us roomed at the same house, this is the first time we have all been together since 1911. Although we were in the minority we had the M. C. M. crowd singing 'On Wisconsin'."

CHEMICALS

Drake, Ronald I., ch'20, address: 431 Griggs Street, St. Paul, Minnesota.

Ragatz, Roland A., ch'20, professor in chemical engineering, was married on the 15th of March to Miss Nancy Hansen of Milwaukee. Address: Millirand Apts., 3027 Wisconsin Ave., Milwaukee.

Zimmerman, James G., ch'04, offers a puzzle to the editor in the matter of his classification. In the March issue he was listed among the civils, and according to the directory he is a graduate in elcetrical engineering. By his own admission he should be listed as a chemical — question: "What kind of an engineer is Mr. Zimmerman?"

MECHANICALS

Brinck, Arne, m'22, has recently taken charge of the office of A. L. Gran Coy at Mukden. His permanent home is in Oslo, Norway. He passed through Madison with his bride in September on his way to his new post.

Hartwell, H. T., m'24, former instructor in hydraulics at the university, is with the Railroad Commission at Madison.

Little, George F., m'27, address: 621 Locust Street, Rockford, Illinois.

Meili, Otto H., m'26, address: 1806 Wisconsin Avenue, New Holstein, Wisconsin.

O'Connor, William D., m'22, address: 6744 Penn Ave., Pittsburgh, Pa.

Parlett, Raymond C., m'16, address: 522 W. Front Street, Plainfield, N. J.

Phillips, Rufus S., m'23, MS'27, address: 545 Gunderson Ave., Oak Park, Ill.

Rietow, Lincoln A., m'23, has been placed in charge of the recently opened Minneapolis sales office of the Pacific Electric Manufacturing Corporation. Address: Pacific Elec. Mfg. Corp., Plymouth Bldg., Minneapolis, Minnesota.

Campus Notes

KRAUT LEADS MILITARY BALL

Slide rules and text books rested, for one night at least, when Coon-Sander's Nighthawks burst forth with music at the 18th annual Military Ball in the Wisconsin Union. Ralph Kraut, ME4, with Nancy Colman, a charming honorary-colonel, led the six hundred couples in the light fantastic movements.

Besides being chairman of the military ball, Kraut has shown by his many other activities that it isn't always detrimental to an engineer's grades to take part in campus activities. Having graduated from a military preparatory school, he naturally is active in R. O. T. C. affaris. He is a member of Scabbard and Blade, honorary military fraternity, is a cadet officer in the reserve corps, and last year was a member of the military ball committee. His activities are not all confined to military doings, however. He is a member of the varsity gym team, of Pi Tau Sigma, honorary mechanical engineering fraternity, and of Theta Chi fraternity.

The ball was one of the outstanding social events of the year, second only perhaps, to the Junior Prom. In recognition of the superior music, the faculty relented sufficiently to make it a one-thirty date night, so that the students would have quantity as well as quality for the price of their tickets, being able to dance one extra hour.

ST. PAT HONORED WITH GREEN FEATHERS

"St. Patrick was an engineer, he was, he was" . . . and to commemorate his birthday, March 17, green feathers were worn by all true followers of the famous inventor of the worm drive. This no doubt aroused jealousy of the same color as the feathers in the hearts of the barristers across the hill. Perhaps this was what incented a letter to Dean Turneaure from the lawyers on the same day, when a monkey broke loose from the biology department. The letter implied that one of our engineers had strayed and he was trying to find some real knowledge in the vicinity of the law building. No doubt the monkey wanted something easier to learn than engineering.

Polygon as yet has made no definite arrangements for a substitute for the St. Pat's parade, which has lacked the support of the students in recent years. Numerous rumors have been circulating about the campus as to what will take the place of the parade, the foremost of which is a general movement for an engineers' ball.

The engineers' recognition pins were put on sale to juniors and seniors on March 25. The pin is a nice looking little gold affair with a red "W" crossed by a slide rule. Only junior and senior engineers are eligible to wear the pins. Polygon is also planning some good speakers in the future.

JUNIOR AND SENIOR CIVILS MAKE INSPECTION TRIP

Eight seniors and forty-five juniors met at the Madison Street Bridge in Chicago Monday, April 7, accompanied by four faculty members and a guide from the city engineer's office and began a three-day inspection trip. They started at 9 A. M. and proceeded to look over the river straightening job, which is nearing completion, and visited several of the more impotant bridges. The afternoon was spent in going over some of the big construction jobs now in progress in the loop district.

The party spent Tuesday morning at South Chicago visiting the Illinois Steel Works where a large building program is in progress. Tuesday afternoon was spent at the steel mill at Gary, Indiana.

The inspection trip has been a feature of the engineering courses for the last thirty years. It offers an opportunity for the students to visit places that are not ordinarily open to public inspection and gives them a conception of modern industrial development that is not obtainable from books. Mining engineers make a trip through the western mining country during the summer. Electricals and mechanicals have a choice of a trip to Chicago and Milwaukee or a trip to the East. Chemical engineering students take a trip to Chicago and Milwaukee in the spring, and civils make a trip to Chicago in the spring and one to Milwaukee in the fall.

The faculty men who accompanied the party were M. O. Withey, L. F. Van Hagan, H. F. Janda, and K. Wendt.

The students were: C. F. Ewald, E. G. Heberlein, M. M. Hill, E. W. Hulbert, K. L. Magee, T. Raccoli, A. C. Schaeffer, P. H. Thern, O. C. Adler, D. L. Anderson, L. W. Bartsh, D. C. Bengs, C. W. Buendling, H. J. Carlin, G. H. Caviezal, A. R. Chermak, D. O. Coe, I. L. Cole, S. D. Drew, J. T. Drew, F. J. Euclide, L. Fuhr, J. B. Graetz, R. Hendrickson, W. R. Hicks, J. L. Innes, R. Jackson, C. A. Knoll, L. F. Kosak, F. C. Ladwig, H. C. Lidicker, W. C. MacDonald, S. W. Medlar, W. A. Milbrandt, C. W. Newing, C. H. Newlin, T. H. Perry, E. J. Peterson, W. S. Proudfoot, C. L. Senn, H. T. Sowls, R. P. Staeffler, T. E. Stephenson, A. L. Streu, W. E. Thompson, J. C. Trieloff, F. I. Vilen, R. S. Wertsh, J. F. Wohlgemuth, A. L. Wolfe, R. E. Wolff, L. A. Yolton, and J. W. Zibell.

ALUMNUS LECTURES TO ENGINEERS

James E. Mackie, CE'23, returned to his alma mater under different circumstances than when he left it. When he received his degree in 1923, he had spent four years of listening to the instructors lecture. On Friday, March 21, he returned to do a bit of lecturing of his own, with the professors and instructors listening, as an authority on his subject "The Correct Uses of Lumber in Construction." Junior and senior engineering classes were dismissed in many cases to hear what he had to say.

Mackie entered the services of the city of Long Beach, California, upon graduating. Pacific coast builders were interested at the time in preparing a standard building code. After he had become executive secretary of the Pacific Coast Building Officials, he had a great deal to do with formulating the code which is now widely used.

ENGINEERS IN ATHLETICS

The concensus is that the engineer, with his laboratories, reports, 30 hour per week schedule, home work and inspection trips has no time for athletic activities. So your operative (a la Damon Runyon) delved into the records, questioned this man and that coach and finally came out with this list of men who are on varsity rosters. They are all engineers and if any one feels he has been omitted he may show his charley horse to the proper authority and we'll brand him an athlete in the next issue.

The engineer is represented on the football squad by Kenneth (Moose) Kruger, CE 2, who was varsity center on the 1929 squad and who will undoubtedly hold that post this fall. Harold Smith, CE 2, was also a member of Thistlethwaite's team last year and performed at tackle.

The roster of Milke Murphy's crew candidates is studded with engineers. Here's the list of slip stick specialists who are working with the varsity eights: Joseph Lucas ME 3, George W. Miller EE 3, Richard Johnson ME 2, Robert M. Wells ME 2, Willard E. Skogland CE 2, Raymond J. Reinke CE 2, William B. Hovey CE 2, Clifford Woodward ME 3 and Harold H. Zabel EE 3.

The gymnastic team claims the attention of almost an equal number of engineers as does the crew. We submit this list of engineers who were under the tutelege of Coach Masely during the past season: Ralph J. Kraut ME 4, Howard Darbo ChE 2, George T. Vick EE 1, Theodore Canepa EE 1 and Byron C. Redeen CE 2.

Coach George Hitchcock, as instructor in the machine shops, has lured a number of engineers to his wrestling squad and we find the following devotees from our ranks: Fred Locher CE 2, Ferdinand Hammer ME 3, Walter F. Karsten ME 3, George Stetson ME 4, Robert L. Hoyle ME 2, Charles R. Earl ChE 2, Louis Z. Smitz Ch 4 and Arthur R. Kreutz ChE 4.

Not being content with this list we trekked to the swimming pool in the armory and found that a number of engineers are members of Joe Steinauer's varsity squad. The list is topped by Arnold F. Meyers ME 3, who is one of the premier breast strokers of the conference. On the varsity squad are also Xerxes R. Raylor ME 2, Geo. C. Hall EE 2, George P. Schipporeit CE 2, Harold F. Falk ME 2.

"We generally have quite a number of engineers on our cross country and track squads," said Coach T. E. Jones and the statement is attested by this group of the followers of St. Patrick: John F. Wohlegemuth CE 3, Louis Berg CE 2, Fred Stolz ME 2, Robert Jenks CE 2 and Karl H. Kundert Min E 2.

Guy Lowman's varsity baseball nine claims only one engineer: William H. Ferris EE 3 is a claimant for an outfield post. Then there is Frederick L. Tiegs EE 4, who will be one of the mainstays on the varsity tennis squad this year.

RAY S. OWEN ELECTED ALDERMAN

Prof. Ray S. Owen, 1806 Kendall Ave., professor in the college of engineering, won the election for alderman of the tenth ward against Herman J. Steffen by the narrow margin of nine votes. Alderman Steffen has held his office for a period of eighteen years.

Prof. Owen is a World War veteran. He served two years in the army, 18 months of that time being spent in overseas service. He holds the rank of colonel.

He has lived in Madison since he entered the university in 1900, and has lived in the 10th ward for 20 years.

Prof. Owen was graduated from the university in 1904. In 1905 he began teaching at the university, and he has taught there continuously except for the period during which he was in the army.

He is a director of the Madison Technical Club, secretary and treasurer of the Engineering Society of Wisconsin, past president of the local Kiwanis club, and a past vice commander of the local post of the American Legion.

In announcing his candidacy, Prof. Owen declared he is in favor of an auditorium and a new city hall providing the finances can be adjusted so as not to impose a burden upon the tax payers of Madison.

O. W. STOREY EXPLAINS PATENTS TO CHEMICALS

"The patent engineer" was the subject of a talk given by Oliver W. Storey, of the Burgess Laboratories, to the student members of the American Institute of Chemical Engineers. He described the duties of this profession as being to watch the progress of research within his company, and to keep in touch with all the essential developments and pass them on to the firm's patent attorney.

The use of the term "engineer" as applying to this job is not strictly accurate, according to Mr. Storey, for the patent engineer must have a great deal of knowledge of law and other non-engineering subjects to qualify for the position, as well as the usual technical knowledge.

He must not only watch his own company's developments, but must keep an eye on the developments of rival concerns, to prevent duplication of research on the same subject, and to keep pace with new developments. Storey described the difficulties of determining the true inventor of a device or process which has been the result of the research of many, and the priority is uncertain.

CONTRACT FOR M. E. BUILDING LET

After a long period of delay due to supposed lack of funds, Governor Walter J. Kohler released the contract for the future home of the mechanical engineering building. The contract has been let to the contracting firm of Findorf and Son, of Madison. At the time this is being written, official orders to begin work had not yet been received, but excavation will begin the day after the order has been signed by the governor. The building must be completed a year after the signing of the contracts, so that next year's students will probably take their steam and gas and other mechanical courses at Camp Randall. There is a possibility that the building will be completed by February, 1931, which would make it possible to house classes in the building the second semester of next year .

The building will cost half a million dollars, $512,812 to be exact. Over $100,000 has been appropriated for heating tunnels, new equipment, and for the removal of the mechanical engineering apparatus from the hill to Camp Randall. Prof. G. L. Larson expects the new building to increase the prestige of the engineering school on account of the modern facilities, and up-to-date laboratories.

Engineering Review

MECHANICS DEPARTMENT TO CONDUCT AIRPLANE TESTS

Wisconsin has been named as one of eight American universities chosen to conduct tests which will aid in the standardization of airplane performance under a common plan. Prof. E. R. Maurer, of the mechanical engineering department, is a member of the committee which drew up the plan at the international aircraft exposition in St. Louis.

the full schedule of the new plan, Dean F. E. Turneaure of the college of engineering said that it consisted of a co-operative scheme for conducting laboratory tests. These tests will be for the rating of speed and other performance characteristics, helping the American aviation industry readjust itself on a more sound economic basis.

Other institutions included in the selections are New York University, Guggenheim School of Aeronautics, Washington University, University of Cincinnati, Purdue University, University of Michigan, Leland Stanford University, and the California Institute of Technology.

PRECISE LEVELING BY GEOLOGICAL SURVEY

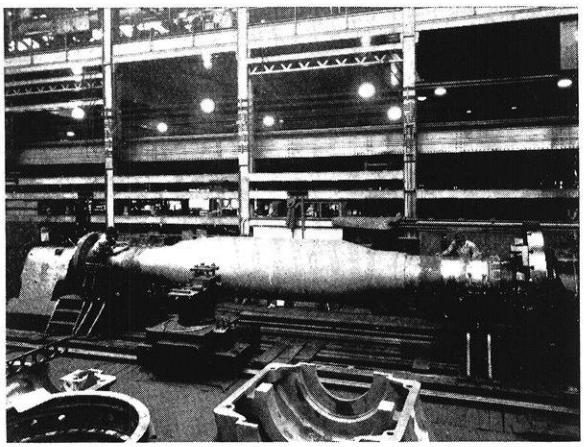
Accurate level lines have now been run by the Geological Survey, Department of the Interior, to six of the high peaks in the eastern part of the United States. Mount Mitchell, in North Carolina, which is probably the highest point in the United States east of the Mississippi River, is 6,684 feet above mean sea level.

Three peaks in the proposed Great Smoky Mountains National Park are Clingmans Dome, on the North Carolina-Tennessee State line, which has an elevation of 6,642 feet; Mount Guyot, also on the North Carolina-Tennessee line, 6,621 feet; and Le Conte (Myrtle Top), in Tennessee, 6,593 feet. Mount Washington, in New Hampshire, is 6,288 feet above mean sea level, and Mount Katahdin, in Maine, 5,267 feet.

The highest known point in the United States, exclusive of Alaska, is the summit of Mount Whitney, in California, which is 14,496 feet above sea level, and the lowest known dry land in the United States is in Death Valley, also in California, which is 276 feet below sea level.

WASTE HEAT AT WORK

The Alpha Portland Cement Company of Martins Creek, Pa., will utilize the waste energy which ordinarily goes up the stacks in the form of heat, to operate most of the machinery in the plant.



The size of this large shaft may be realized by comparing it to the two workmen in the picture. It weighs seventy tons.

By conducting the heat away from the stacks to specially designed boilers, sufficient steam is obtained to drive the turbine-generator, which in turn furnishes electricity to operate the mill machinery. This installation is the largest single unit operating on waste heat in the world.

This turbine-generator will result in the saving of tremendous quantities of waste heat — enough to heat approximately 500,000 curling irons at the same time. The cost of the power obtained from this waste heat will compare favorably with the cost of obtaining power from any waterfall.

LARGE GENERATOR SHAFT MANUFACTURED

One of the largest shafts ever built was recently machined in the shops of an eastern machine shop. This shaft weighs approximately 140,000 pounds and has a maximum finished diameter of 53 inches with an overall length of 32 feet. It was forged from an octagonal ingot approximately 82 inches in diameter and weighing 290,000 pounds.

It is designed to be supported with the rotor on two large bearings, 30 inches in diameter by 60 inches long. The shaft will be used in the rotating part of a 60,000 kv-a., 514 rpm. horizontal generator.

1930 HIGHWAY OUTLOOK

Cooperating with President Hoover in his plea to enlarge all construction programs as much as is practicable to ameliorate the unemployment situation, the States and their counties will spend in their road building programs for 1930 at least $250,000,000 more than they spent in 1929.

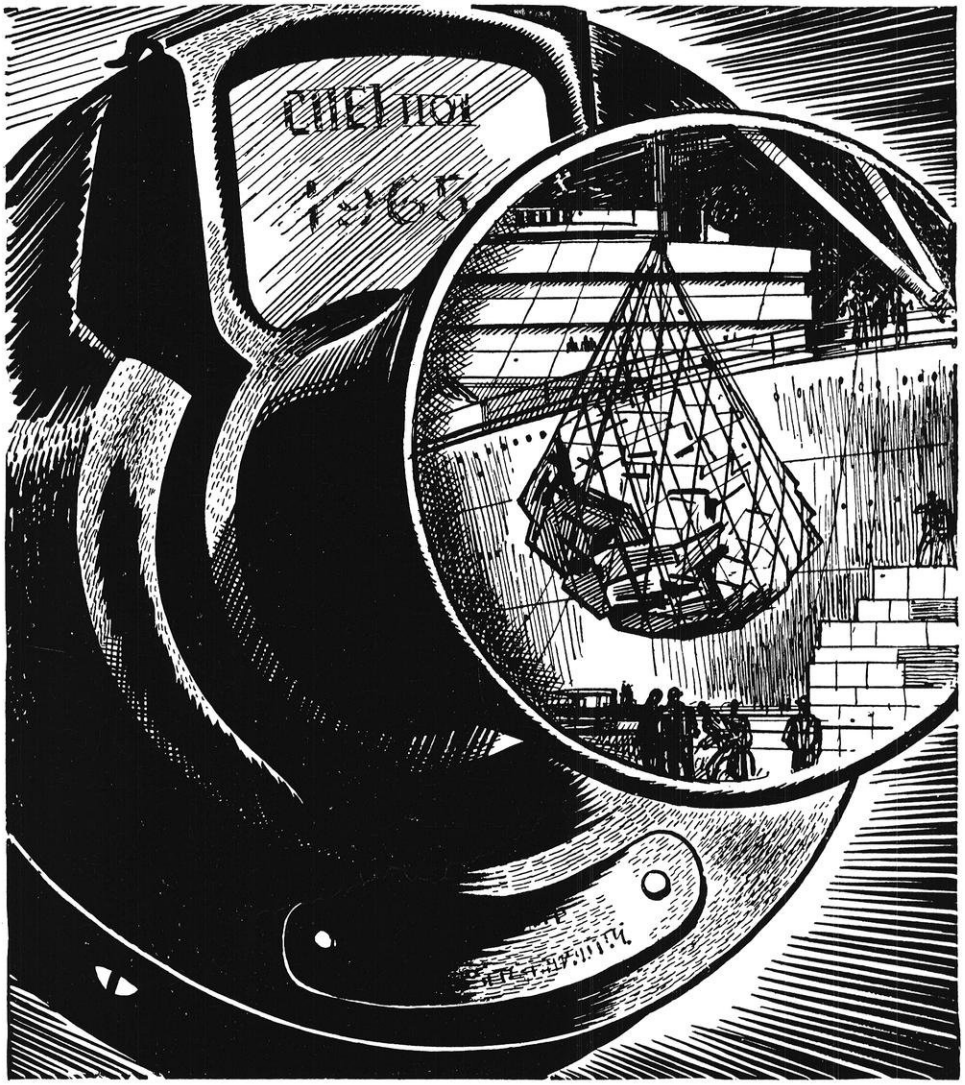
Reports received from State highway departments and compiled by the Bureau of Public Roads, U. S. Department of Agriculture, show that State and local authorities plan to spend $1,601,167,455 fro highway improvement in 1930.

The planned expenditure by State highway departments for construction and maintenance of State highways is $937,500,455; the balance, $663,667,000, will be spent, according to the estimates, on local roads and bridges. The State highway officials of 45 States estimate the total length of roads to be improved by them in 1930 as 32,532 miles, an increase of 3,126 miles over the estimate in the 1929 programs. Three States failed to report contemplated mileages for 1930.

The highway departments of all States will control the maintenance of 281,393 miles of highways this year, an increase of 32,381 over the mileage under State maintenance in 1929. Gradually, the States are taking over into their systems for maintenance the more important county and local roads of the country.

The States of greatest population

(Continued on page 256)



A world-wide market place

Eighty-five per cent of the world's telephones can be reached from any telephone of the Bell System. This includes those of Canada, Cuba, Mexico, and—by the new radio-telephone link spanning the Atlantic—most of the countries of Europe.

Already many American business men are using this service to expedite the transaction of foreign business and are finding it quick, convenient and profitable.

The future possibility of talking directly with almost anyone in the world who has access to a telephone is enough to stimulate any man's thinking—not only from an engineering standpoint, but because of its significance to American industry.

BELL SYSTEM

A nation-wide system of inter-connecting telephones

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES — BELL SYSTEM

"OUR PIONEERING WORK HAS JUST BEGUN"

Side Shots

DEFINITIONS:

Magician: One who can make his wife believe that the powder on his lapel is dandruff.

Apex of cone: Where there isn't any ice-cream.

CONSERVATION OF ENERGY

Give an example of wasted energy.

Telling a hair-raising story to a bald-headed man.

TOUGH!

Butler: "Sir, your wife has eloped in the car with the chauffer!"

Doctor: "Dammit! Where will I find another like her; why I used to get twenty miles to the gallon out of the old crate!"

WARNING!

All drivers keep their cars off the streets until the end of school, since Arthur Bright is uncrating his 1914 Ford, and will need the entire street for navigation.

Hubby: "Gee, but I miss that old spittoon!"

Wife: "That's precisely why I took it away!"

Ask a lot for the rent of this room, don't they?

Yes, about six times this month!

Mary had a little dress,
A dainty bit and airy;
It didn't show the dirt a bit,
But oh, how it showed Mary!

Mary had a little lamp,
A jealous one no doubt;
For every time her boy-friend came,
The little lamp went out.

MONTH'S WORST JOKE

Captain (at inspection): "How much time did you put on this rifle?"

Cadet: "An hour sir, but I couldn't get those rings out of the barrel."

Rumor hath it that a lofty senior was heard to say in Seminar 2B that a cynic was a place where dishes are washed.

All the M. E.s and other blotters will no doubt be glad to know that John has moved to a new and more spacious place of business.

He has installed a bar in the cellar, too — stealing Pete's stuff. Step up and name your poison, boys!

Believe it or not, but if all the ponies used in S. & G. exams were to be laid end to end in Mr. Larson's office — there would be one *helluva fuss* . . . . .

WET SMACKS

Mr. Charles Nelson, of the U. S. Geological survey and instructor in topog at the summer camps, tells of the man who, when sent on horse-back to traverse certain trails, kept track of the strides of the horse by counting the strides of all four legs.

The opponents of Darwin may suffer a blow when they hear that there is a similarity between man and mule, they both pace 1000 to the mile.

Then did you know that most people whose minds are continually in the gutter become Sanitary Engineers?

EVOLUTION

Time was when little Willie would go to the drugstore and get an ice-cream cone, and stop on the way back to bring father home from the corner saloon; now he goes to the saloon to get the ice-cream, and stops at the corner drugstore to collect father.

TERRIBLE

"Two horses killed in crash; father of one hurt." — Headline in small town newspaper.

Bond house clerk (dictating to steno): "Do you retire a loan?"

Steno: "No, I sleep with grandma."

PAGE EINSTEIN

A certain chap had an old hack that kept him poor buying gasoline. Recently he bought a new set of tires that were guaranteed to save 15% of the gas; a new carburetor that saved him 25%; a new transmission that saved him 15%; a new oil that saved him 15%; a new water pump that saved him 20%; a new set of valves that saved him 20%, and a new rear axle that saved him 18%; now he has to stop every 100 miles and bail out his tank.

OUR OWN LIL' DAILY PARADOX

When a diplomat says "Yes", he means "Maybe", and when he says "Maybe" he means "No", and if he says "No" he's no diplomat;

while

when a lady says "No" she means "Maybe", and when she says "Maybe" she means "Yes", but if she says "Yes" she's no lady!

THINK IT OVER, CIVILS!

Genuine, silk-lined cuspidor to the first sewer-digger that figures it out without a log table:

A report has been going around that a certain Theta Xi Chemical has been sober for three days straight.

Wife: "How interesting! The paper says that every fourth child born is a Chinese."

Husband: "Gee, we're lucky!"

Wife: "Howzat?"

Husband: "We've only got three."

Tan: "Sorry to keep you waiting; I just been setting a trap for the wife."

Jan: "Gracious! what do you suspect?"

Tan: "A mouse."

ENGINEERING REVIEW

(Continued from page 252)

and industrialization in which unemployment, naturally, is greatest, show the highest contemplated expenditures. The Middle Atlantic States, comprising New York, New Jersey, and Pennsylvania, plan to spend $374,835,310 on improvement of State and local roads; the East North Central States of Ohio, Indiana, Illinois, Michigan, and Wisconsin plan to spend $303,696,000.

USE OF TREATED WOOD

"A saving of $145,000 a day accrues to the railroads of the country through the present practice of using chemically treated timber for cross ties and other purposes," said C. C. Cook, maintenance engineer of the Baltimore & Ohio, at a conference of the public utility group of The National Association of Purchasing Agents, held recently at the Department of Commerce in Washington.

Mr. Cook addressed this meeting as a member of the National Committee on Wood Utilization of the Department of Commerce.

"Since 1909," Mr. Cook said, "the consumption of treated wood in this country has increased from 75 million to 336 million cubic feet. The railroads consume three-fourths of this quantity at the present time, largely for ties. The life of chemically treated ties is frequently treble that of untreated ties."

The speaker predicted that the average life of ties will soon be more than 20 years. When this is true, he said, the railroads will save $287,000 a day.

METRIC MEASURES

Petitions from all over the United States, in favor of adoption of the decimal metric standards, are pouring in upon the Committee on Coinage, Weights and Measures of the House of Representatives, which is considering the metric issue.

Hearings are to be held within a couple of weeks on the two metric resolutions introduced by Hon. Fred A. Britten of Illinois — one providing for a survey by the United States Secretary of Commerce as to the advantages of world metric standardization; the other providing for gradual adoption of the metric units in the United States by 1935.

Meanwhile, metric advocates have launched a nation-wide campaign to win approval of the pending legislation. At its recent convention at Des Moines, the Metric Association laid plans for greatly increased activity. The All-America Standards Council is also urging prompt legislative action by Congress, establishing the decimal metric units for general use in merchandising. Its executives announce that metric standardization is urged by Thomas A. Edison, John Hays Hammond, Frank O. Lowden, Samuel Vauclain, John J. Pershing, Theodore Roosevelt, Franklin D. Roosevelt, Arthur Capper, E. N. Hurley, William G. McAdoo, Roger Babson, Irving Fisher and many others eminent in national affairs.

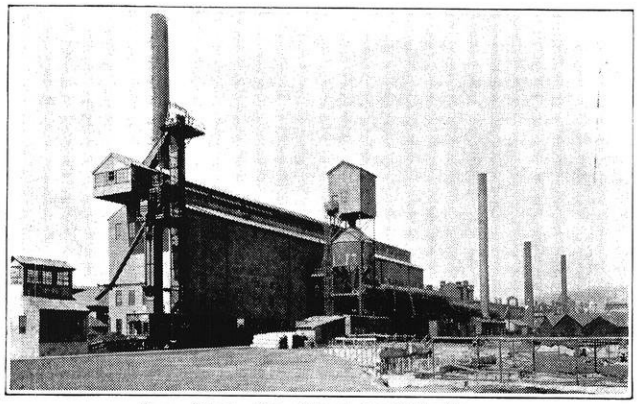
The chairman of the Committee on Coinage, Weights and Measures, of the House of Representatives, Washington, D. C., is Hon. Randolph Perkins of New Jersey, and it is to him and his committee that metric petitions are being send.

MACKIE TALKS ON LUMBER

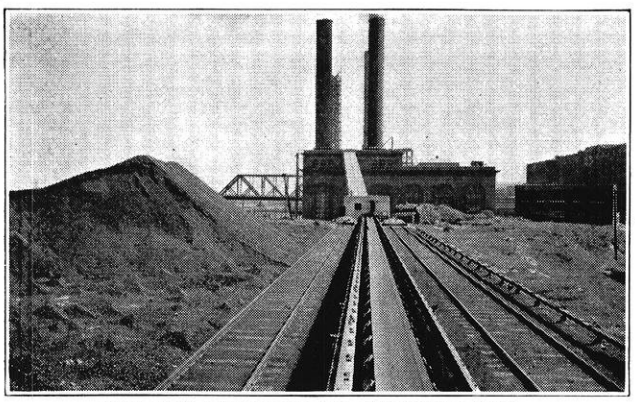
The lumber available in the United States today is just as good as any we have had in the past, according to James E. Mackie, Wisconsin graduate and structural engineer for the Na-

Power—the Force Behind Modern Civilization

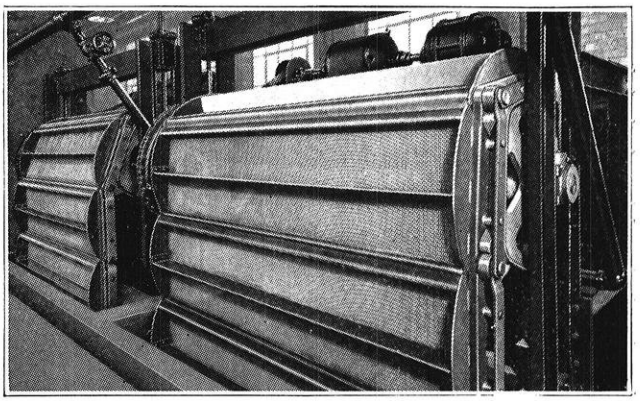
Mightiest of all the mighty forces behind modern civilization is Electric Power. For Electricity extends its benefits to all. With power great enough to turn the huge wheels of industry, it is so easily controlled, so convenient, and so low in price, that the housewife may use it to heat her iron, to run her sewing machine, or to operate her vacuum cleaner.



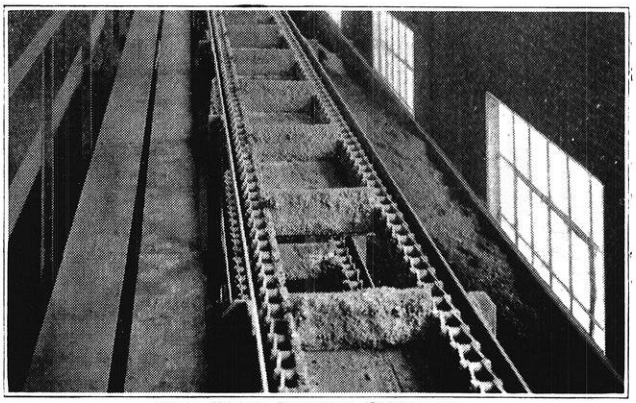
Rex Coal Handling Installation



Rex Belt Conveyor for Handling Coal



Rex Travelling Water Screen Installation



Rex Drag Scraper Conveyor

Rex Equipment has done much to bring the price of electric power within the reach of the householder and the small business.

Rex Coal and Ash Handling Systems, Rex-Stearns Silo Storage Systems, and Rex Traveling Water Screens do their part in reducing Power Plant costs, and lowering the price of electric power.

Rex Equipment for the mechanical handling of material is used in practically every industry. We shall be glad to send you information upon its use in the industry that interests you.

CHAIN BELT COMPANY
757 Park Street Milwaukee, Wis.

REX Reg. U. S. Pat. Off.

Power Transmission • Conveying Construction Equipment

CHAIN BELT COMPANY

THE STEARNS CONVEYOR COMPANY, *Division of Chain Belt Company,* East 200th St. and St. Clair Avenue, Cleveland, Ohio

CONCRETE MIXERS • PAVERS • PLASTER MIXERS • PUMPS • SAW RIGS • CHAIN • SPROCKETS
BUCKETS • TRANSMISSION • ELEVATORS • CONVEYORS • TRAVELING WATER SCREENS

Please mention The Wisconsin Engineer when you write

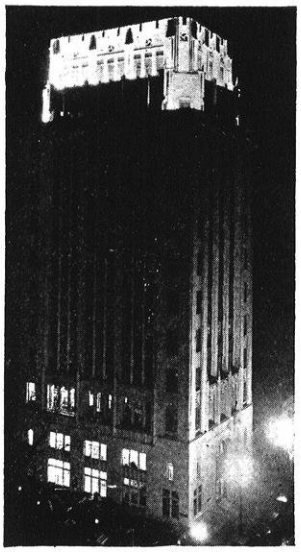
tional Lumber Manufacturers Association, who spoke to the junior and senior engineers in the auditorium at 10 a. m on March 21.

Mackie, who is a graduate of the civil engineering course, class of 1923, became connected with the building inspector's office of Long Beach, Calif., after graduation and was rapidly advanced to be chief engineer of the department. He left that post to become executive secretary of the Pacific Coast Building Officials Conference and had charge of the preparation of the standard building code that has since been adopted by more than seventy cities.

There is still enough virgin timber standing in this country, according to Mr. Mackie, to make a strip seventy miles wide across the United States. If second and third growth be included, the strip could be widened to 225 miles. Not only is there much fine timber; in addition, marketing methods have been greatly improved. Lumber is now sold under standard grading, and its strength is guaranteed by the manufacturers, so that structural designers are able to produce structures of well balanced strength.

FLOODLIGHTING THE BUILDING AND LOAN TOWER AT SOUTH BEND

A prominent landmark by day and a picture of outstanding beatuty by night is the new Building and Loan Tower recently dedicated at South Bend, Indiana. In addition to being the tallest building in South Bend, it has been adjudged one of the most attractive structures in the country. It is 150 feet high with a setback tower, a style of architecture prevalent in larger cities where building heights are subject to zoning regulations.



The adaptability of flood lighting to new skyscraper design is shown in this view of the Loan Tower at South Bend.

The Tower lends itself to elaborate floodlighting at night which already has marked the new building as a point of civic interest in South Bend. When darkness falls, the tower is illuminted by a battery of thirty-five 500-watt projectors so arranged and designed that one, two or more colors may be used. This colored lighting may be changed and varied in keeping with the season and affairs of local interest. In addition to the ornamental lighting of the tower, engineers were called upon to provide ornamental lighting for the facade of the building. This has been very effectively accomplished by concealing powerful reflectors in ornamental lanterns mounted on cast iron standards at the curb in front of the building. Additional floodlights are used to illuminate a huge painted sign on the west side of the structure.

THE GREAT ENGINEERS

The greatest engineer of all time is James Watt, improver of the steam engine, the deans of American engineering schools have decided.

A list of the greatest engineers, both of all time and of the last 25 years, was made public for the first time when the students in the School of Technology, Villanova College, met to make plans for the celebration of the 25th anniversary of the Villanova engineering department. The celebration will be held in June.

Dean Carl T. Humphrey of the Villanova School of Technology invited every dean of engineering in America to name the greatest engineers. Their selections appear in two groups.

The five outstanding engineers of all time:

James Watt.

Leonardo da Vinci, planned and constructed the Martesana Canal.

Thomas A. Edison.

James B. Eads, boat and bridge engineer.

Ferdinand de Lesseps, French engineer who built the Suez Canal and projected the Panama Canal.

The Villanova survey shows that the 10 greatest engineers of the last 25 years are:

Herbert Hoover, for his work in mining and administration.

Chas. P. Steinmetz, electrical genius.

Thomas A. Edison.

John F. Stevens, for his work on the Panama Canal and as head of the American Railway Mission to Russia, 1917-18.

John Hays Hammond, mining.

George W. Goethals, engineer-in-chief of the Panama Canal.

George W. Westinghouse, airbrake inventor and pioneer in introducing alternating current machinery.

Guglielmo Marconi, inventor of wireless telegraphy and responsible for first broadcasting in England.

Henry Ford.

Ralph Modjeski, engineer of the Delawara River Bridge at Philadelphia and the Ambassador Bridge which connects Michigan and Ontario, Canada.

EIGHTEEN RAILROADS NOW ELECTRIFIED

Eighteen railroads in the United States which formerly operated entirely by steam, now operate electrically on about 4,300 miles of track, according to a survey of railroad electrification just completed by the Copper & Brass Research Association.

This electrification represents about 1,900 miles of route, while of the 4,300 miles of track approximately 3,150 miles are in main lines. In this electrified territory the railroads have in service 465 electric locomotives and 2,750 multiple-unit cars for passenger service. Of these cars, 2,150 are motor cars and the rest are trailers.

In addition to the elecrtification already completed, six railroads have similar work under construction, two railroads have definitely announced further electrification programs, and six new projects have been tentatively announced. Definitely authorized projects, says the survey, will within five or six years almost double the present electrified mileage of the steam railroads.

The survey further points out that although less than 1 per cent of the route mileage of American railroads is now electrically operated, more than 100,000,000 pounds of copper have been required for the various undertakings, and that other definite projects will within a few years practically double the poundage of copper applied in railroad electrification.

EDITORIALS

(Continued from page 247)

WHO SHALL PAY FOR OUR HIGHWAYS? The general public has, within the last decade, awakened to a realization that the problem of maintaining and financing our highways is one of serious national import, involving upwards of a billion dollars annually, and influencing as it does the commercial and industrial activity of the nation. It has truthfully been said that in the final analysis production must start with the highways and distribution must end on them.

Our principal source of highway funds in the past has been the taxation upon property, and almost 90 per cent of our highway funds were raised in this manner. The realization on the part of the property owners that they were bearing an unproportionate share of the burden of building and maintaining a highway system has led to a public sentiment which is unanimous in demanding a halt in this form of taxation. That this public sentiment has been effective in reducing the highway burden on the property owner is demonstrated by the fact that from a 90 per cent share in the past the property owner's share had decreased to 36 per cent in 1921 and to 25 per cent in 1924.

It may be said with a reasonable sense of certainty that the immense highway development of today, the demand for smooth-riding, all-season roads, the clamor for more and better highways, is due directly to the almost unbelievable increase in the number of motor cars within the last decade. From 3 million to 23 million motor vehicles in ten years! Highway expenditures have grown with the motor vehicle traffic. When motor cars and motor trucks began to be numbered by millions, highway expenditures climbed into billions.

Public opinion has declared in unmistakable terms that the motorist must bear his equitable share of the highway bill if our present rate of highway expansion is to continue. Is it not reasonable that the cost of highway service be considered something just as necessary and essential to the operation of a car as the cost of gasoline, tires, overhauling, or any other legitimate expense of the automobile?

HENRY SWIFT IVES ON GOVERNMENT OWNERSHIP "Government ownership is the product of loafing minds and loitering ambitions. It is the indolent offspring of the static mind, and its ancestry may be traced back through a long line of dawdling political sooth-sayers. As a theory it lacks imagination, originality, inspiration, and romance. As an actuality it is a stupid, dull, languorous method of carrying on the work of the world. It is the substitution of Government deficits for private profits. It is the dragging brake on individual enterprise and a stubborn barrier to industrial progress.

"It is the Santa Claus idea of government, heralded by political sleigh-bell ringers. It has never created anything except jobs. It is destructive of wealth growth and productive of debt growth. It deadens the will to do and nourishes the will to be done for. It makes politics instead of business the national dividend producer."

PUBLIC UTILITY CONTROL: AN EXPERIMENT

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ested student wants to know only which one will work most satisfactorily. Probably no definite choice will be possible for many years. It may well be that each will prove itself in certain situations and both will continue. The important thing for the present is to approach the issue sanely, recognizing successful regulation and successful ownership when cases of either appear.

The experiment will continue and it may be well to list some of the subjects in regulation which have to date been greatly neglected. Methods to determine the rate of return necessary to attract capital have not been devised. We can find it easily enough for those securities sold in the open market, but what of common stocks? These are closely held and there is no market price. Operating standards of efficiency have been practically ignored by Commissions to date. Accounting for maintenance and depreciation presents a problem which has been two much neglected. These have been waiting for twenty years for proper attention. New problems such as interstate transmission of power, holding company control, state and federal jurisdiction have appeared. And there are many others old and new.

PUBLIC UTILITY VALUATION — REASONS FOR INVESTMENT BASIS

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ever may be necessary to make the business attractive to capital, the very fact of the availability of capital for investment in the business would seem to be evidence that it is securing a fair return. Compensation for its use determines the flow of capital into the industry, and if fair compensation is paid and the business is kept continuously attractive for the introduction of capital it is difficult to see why any speculative element should be introduced or that fair treatment of the common stockholder requires that he should either reap the benefit of speculation or suffer the losses.

Electrification of the division of the National Railways of Mexico between Mexico City and Cuernavaca will be effected during the current year, it is authoritatively stated. Engineers who have completed a survey of the line say that operation by electricity will be much cheaper than the present steam power. Electrical energy will be furnished by the Mexican Light and Power Company which owns large hydro-electric plants ni the Necaxa district.

Concessions have been granted by the Mexican government to the German-Mexican Light & Power Company for the construction and operation of large electric power plants at Aldam and Gonzales, State of Tamaulipas, and for building transmission lines to serve fifteen cities and towns.

Companies affiliated with the Electric Bond & Share Company of New York have made investments totaling nearly $100,000,000 in electric light and power plants and transmission systems in Mexico since 1927 according to government figures. Fourteen is given as the number of plants under control.

ENGINEERS CHASE NO FANTASIES

(Continued from page 239)

of his attention, important thought they may be. In proportion as he has mastered the basal sciences will his success in real engineering appear.

It should also be remembered that the successful engineer is a man of affairs. That is to say he knows how to get along with men, how to present his ideas to them, and to interest them in his projects. No one will back any great projects unless they are sound and are presented in an interesting and cogent manner. So the power to express himself clearly, tersely and convincingly is almost as important to the engineer as to the lawyer. Consequently with all the work of studying the basal sciences and the modes of using them in practice, the engineering student must find time to pursue some general studies in the so-called humanities such as history, economics, philosophy and political sciences. The change to these should prove to him a restful and interesting diversion from his highly technical studies, and the time spent upon them certainly will prove to be of great value in his future career.

If in addition to all this the engineering student is interested in art or music or both, he is indeed to be congratulated; for the cultivation of these will not only give him rest from his technical work, but it will by training his emotions and imagination enable him to produce a finer and higher grade of products, and thus add materially to his personal enjoyment of life and his value to the public as an engineer.

STATE-LINE GENERATING STATION

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pit which is in a small building just outside the boiler house. From the receiving pit, the ashes are loaded into cars by means of a grab bucket crane. Storage facilities are provided for 125,000 tons of coal, and the coal handling equipment has a capacity of 25 cars per hour. The loaded cars are pulled up an incline to the car dumper by a "Car Mule", securely held in position, and turned upside down, thus dumping the entire load. The empty car is righted and sent down the incline on the other side of the dumper, its speed being controlled by a retarding device. The whole process is under the control of men stationed near the dumper. The coal is conveyed to the boiler bunkers by an overhead conveyer, and is fed into the crusher by gravity. The amount of coal entering the burners is controlled by the crusher speed, which with the amount of air is controlled from the boiler control panel.

The two smoke stacks are of steel construction, concrete lined, and stand 250 feet high with a mean diameter of twenty feet. Forced draft is used, and dust and soot eliminators are used on all of the boilers.

The high pressure turbine is direct connected to an alternator which is rated at 76,000 kilowatts at 85 per cent power factor. Each of the low pressure turbines is direct connected to an alternator of 62,000 kilowatts at

85 per cent power factor, and also an auxiliary generator for station service which is rated 4,000 kilowatts at 75 per cent power factor. Each generator has its own direct current exciter, and one spare motor generator exciter has been installed. Each of the main generators is a four pole machine, revolving at 1800 r. p. m., and generating electricity at 22,000 volts.

The State-Line installation is one of the first to use completely enclosed metal clad switch-gear. No physical contact can be made with any live part. The bus, those circuits to which the generator output is supplied, and from which energy is taken for the outgoing circuits, is divided into three sections, one generator supplying each section. Each section is served with seven oil circuit breakers, and suitable generator reactors to lessen the shock of a severe short circuit. The entire bus is in duplicate so service will never suffer interuption due to switching difficulties. The voltage on the bus is 22,000 volts, and the output to the transmission lines is at 33,000, 66,000 and 132,000 volts.

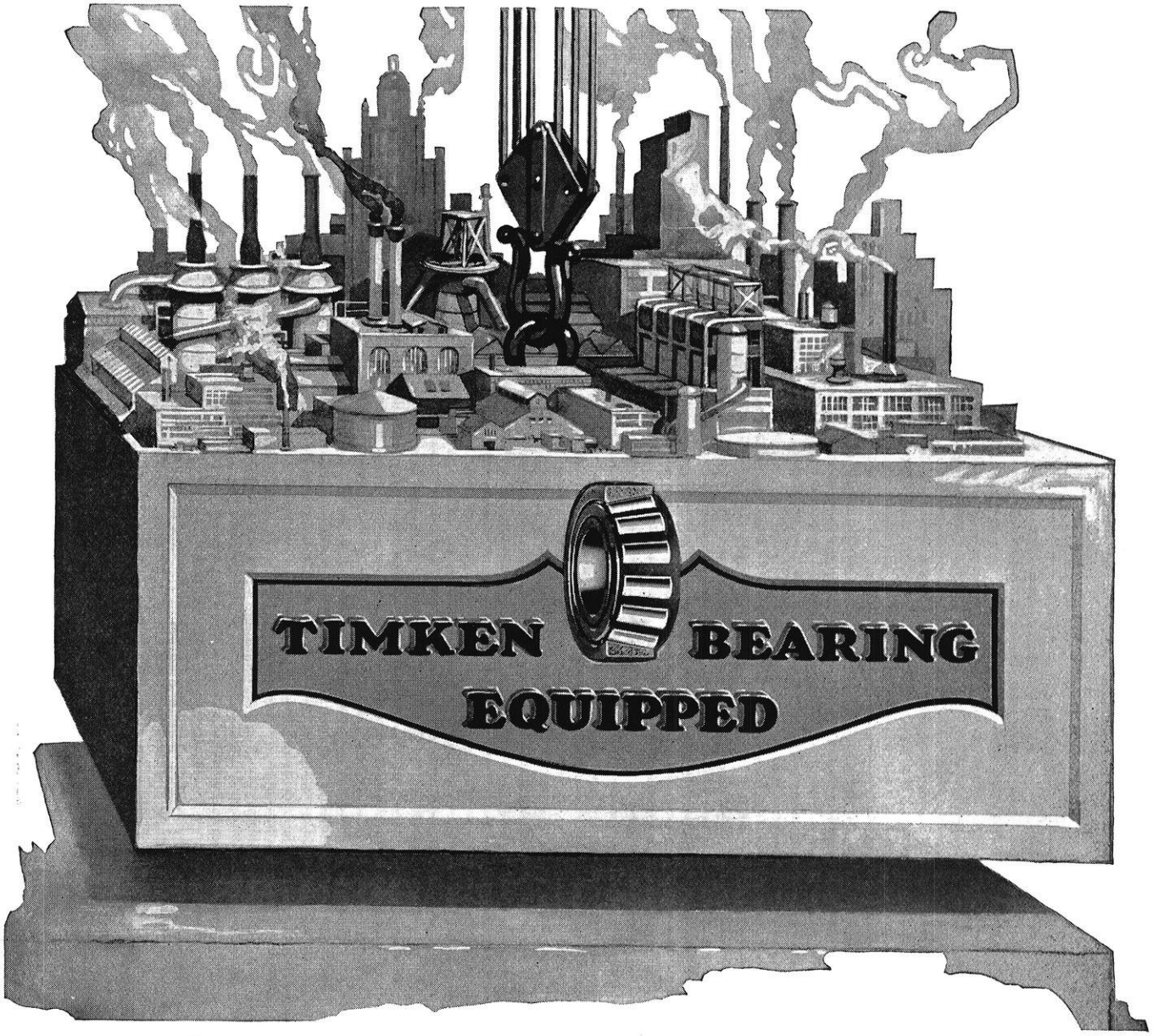
All of the switchgear is supported on a series of three open steel frameworks located outside of the station proper. Each phase of the three phase circuit has its own housing to prevent a direct short circuit between phases. In the construction of the bus, the framework was first erected, then the pipes and boxes which form the conductor housing were put up. The conductors, insulated and fitted with center spacers were drawn into the pipes and interconnections between the conductors were made in the junction boxes. The pipes and boxes were then filled with insulating oil. All of the bus pipes and boxes are connected to oil headers which take care of oil leakage.

A traveling elevator, on tracks beneath the structure provides a ready means of lowering the circuit breakers to "disconnect" position for inspection or for taking them down completely for repair. Interlocking switches are provided such that the breakers cannot be operated once they are lowered from their normal position, thus preventing injury to attendants who may be working on them.

The entire output of the station is transmitted at 33,000, 66,000 and 132,000 volts. The voltage is stepped up from 22,000 by eighteen transformers, with a total capacity of 360,000 kilowatts. This transformer capacity assures flexibility under varying demands.

The complete control of the generating and power delivery is centered in the operating room, which is next to and on the same level as the turbo-generators. Each breaker is controlled by a small knob on the benchboard in the control room, with a system of small colored electric lights to show when the breaker is in. Transformer output is also controlled from the benchboards.

Provisions have been made for moving the control to a more central location when the additional units are installed. The addition of the second which will take about two years to complete will make State-Line the largest generating station in the Chicago District.



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