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ASPECTS OF THE REPRODUCTION THEORY OF VALUATION

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There exist today certain attorneys, engineers, experts, and others who are prone to contend that the courts of authority sanction *only* a reproduction method of valuing public-utility property, to the utter exclusion of all other methods of valuation; and particularly is this statement true of utility representatives in general. Without going into an exhaustive treatment of the subject in support of a contrary view, it may be well to discuss briefly one or two typical court decisions which apparently *may* be construed in accordance with the general theories of the advocates of reproduction valuations.

In treatises upon valuation of public-utility property, the pioneer case of Smyth vs. Ames is customarily cited to show that, in addition to a reproduction method of valuation, fair and reasonable rates should be fixed only after the original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stock, the present as compared with the original cost of construction, the probable earning capacity of the property under particular rates, the sum required to meet operating expenses, and other matters have been ascertained, but it is frequently argued that subsequent court decisions have a tendency to give much greater weight to the reproduction theory than to the other elements of value contained in the following precise language of the Supreme Court of the United States, in Smyth vs. Ames, to-wit:

"We hold, however, that the basis of all calculations as to the reasonableness of rates * * * must be the fair value of the property being used by it for the convenience of the public. And in order to ascertain that value, the original cost of construc-

tion, the amount expended in permanent improvements, the amount and market value of its bonds and stock, the present as compared with the original cost of construction, the probable earning capacity of the property under particular rates prescribed by statute and the sum required to meet operating expenses, are all matters for consideration and are to be given such weight as may be just and right in each case. We do not say there may not be other matters to be regarded in estimating the value of the property. What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience. On the other hand, what the public is entitled to demand is that no more be exacted from it * * * than the services rendered by it are reasonably worth." *

The basis of the claims that the courts invariably favor a reproduction theory is found in the language of certain judicial opinions, in language which is often misconstrued. For instance, in Des Moines Water Company vs. City of Des Moines, the court says:

"The question is not what it [the plant] cost, although such evidence is admissible as having a bearing; the question is not what the plant some day may be worth, although evidence with reference thereto may be considered as having a bearing; the question is: What is the value of the plant today?" †

From such a citation it is argued that the value of the plant must be the reproduction value and that the words, "The question is not what it [the plant] cost," mean that an original-cost valuation is to be given no weight whatsoever.

There is a vast difference, however, between the price which may have been paid *in toto* for a plant ("what the plant cost," to use the court's language) and a properly prepared original-cost valuation. A correct and comprehensive original-cost valuation has as its basis the same inventory as does the reproduction valuation; but, instead of using present day prices (or five year average prices) in the appraisal, the actual cost prices paid by the utility are used for both labor and material; or, in the absence of records of the actual original costs of items of material and labor, a competent appraiser estimates the original cost as of the time when the equipment was installed and under the exact conditions of its installation.

* 169 U. S. 466.

† 192 Fed. 193, 196.

Likewise, in Cumberland Telephone and Telegraph Company vs. City of Louisville, the court said:

"It would seem clear from the decisions that the most material question in such cases is that the *reasonable value* of the property 'at the time it is being used for the public,'—that is to say, the *time at which the question arises*—it being upon the reasonable valuation at that time that the company is entitled to earn a fair return * * *. The value of a plant may depend upon good fortune, upon good management, or upon fortuitous circumstances, but in every event the reasonable value of the property '*at the time it is used for the public*' is the value we are to ascertain for the purposes of this controversy." *

From the language "value of the property at the time it is used for the public" and from the similar language of other court decisions, it again is argued that the reproduction method of valuation must be used exclusively. It seems to have escaped the notice of many reproduction advocates that the language of the court may well be interpreted to mean "the reasonable depreciated value of the *used and useful* property at the time it is used for the public."

Many courts have sanctioned and justified the reproduction theory because generally it is assumed that precise original costs ordinarily are difficult to secure. Usually the record before the court of review has little tangible evidence relating to a properly prepared original-cost valuation. The record often may confuse an investment, the stocks and bonds, and a recent purchase price; and very probably the said record contains little or nothing relating to the original costs of the various items embraced in the inventory. Before construing the language of a court which is reviewing a record taken in a trial court, and resolving such language in favor of some reproduction method of valuation, it is well to ascertain first what that record may contain on the subject of original cost.

Of a proper original-cost valuation, Ex-Chairman Halford Erickson of the Railroad Commission of Wisconsin stated in a paper presented before The Conference on Valuation, held under the auspices of the Utilities Bureau, in Philadelphia, a year ago:

"When the original cost of the existing property is desired, it can be computed upon the same inventory as that used in de-

* 187 Fed. 637, 642.

termining the cost of reproduction and upon prices which cover the period when the property involved was put into the plant. Such price lists may be had partly from the records of the plant and partly from other sources. In this way the original cost of the existing property can be had with even greater accuracy than the cost of reproduction." *

It is interesting to note that Chairman Erickson, after years of experience and participation in rate-making procedures, volunteers the opinion that even in the absence of books and records, "original cost of existing property can be had with even greater accuracy than the cost of reproduction."

Despite the many citations from court decisions which, when read apart from the entire decision, may be construed as more or less favorable to one or another of the reproduction methods of valuing utility property, it is noteworthy that no authority of impeccable standing is to be quoted in showing that an estimate of the cost of reproducing the property (with or without deduction for accrued depreciation) is the sole and only guide to a reasonable and adequate valuation of a utility property for rate-making purposes. On the contrary, the inconsistencies of the reproduction method have been scored time and again. It is only recently that the Supreme Court of the United States, in the Des Moines Gas Case (238 U. S. 153), repudiated the reproduction method when applied to what is commonly termed in valuation work "undisturbed paving." The general unstableness of the reproduction-new theory was realized and understood by prominent proponents of the Federal Valuation Act. Senators Bristow of Kansas and La Follette of Wisconsin, on February 24, 1913, participated in the following colloquy on the floor of the United States Senate:

Mr. Bristow:

"There is one point I wanted to bring out with regard to that feature of the bill that requires the Commission to ascertain the cost of production new. Such a finding, in my opinion, is not of any great value, so far as the rate making is concerned. It is a vacillating quantity; it does not represent in any sense the investment of the company in the construction of the road. To illustrate: In the suit that was pending the estimated cost of the reproduction of the Northern Pacific Railroad was involved.

* The Utilities Magazine, Vol. 1, No. 3-113.

I am informed the same engineer reported in 1907 and in 1909 as to the cost of the reproduction new, and the value fixed in 1909 was one hundred and eighty-five million dollars more than the same engineer fixed the value of reproduction new in 1907."

Mr. La Follette (in part):

"Let me say to the Senator on this question that the Supreme Court of the United States has listed that as one of the values to be considered, and it has not yet by any express declaration eliminated it as a value to be ignored. So it seemed to the committee that we ought to give it its place here. I will, however, say to the Senator that I am confident that the views of all the advanced commissions of the country that are doing this valuation work are that there should be very inconsiderable weight given to reproduction new." *

The reproduction method of valuing property is relied upon by utilities mainly because it automatically takes care of the great appreciation which has occurred during recent years in the cost-new of nearly all items of equipment and in all classes of labor. Land, in particular, falls into this classification, and a court of authority has ruled that the real property of a utility should be valued at its present-day market value, and not at its original cost plus the cost of improvements. Under this and other similar rulings of the courts, it may be argued more or less effectively that, even though a utility may steal equipment without being apprehended and may convert that equipment into used and useful property in the service of the public, the stolen equipment must receive due recognition in a valuation and rate-making proceeding. Whether or not this view will prevail ultimately, under a continuance of state regulation, is a rather debatable question at the present time.

A simple case will serve to illustrate the fallacy of giving indiscriminately too great weight to appreciation in utility property. Assume that an electric plant in a state where the laws provide for state regulation costs $100,000, and assume further that the regulatory body of jurisdiction, after investigation, has fixed rates such as will yield full operating expenses plus five per cent *per annum* ($5,000) for accruing depreciation and seven per cent *per annum* ($7,000) for a fair rate-of-return. At the end of five years, provided no material change is made in the

* Congressional Record, 3801.

said electric property, the utility has accumulated $25,000 (plus earnings) in a depreciation fund, and each year has paid a full and adequate rate-of-return upon the investment of $100,000. During these five years, if perchance the prices of labor and materials advance so that the estimated reproduction-cost-new according to expert appraisers would be $110,000, there has been an increment, over and above a fair rate-of-return, amounting to $10,000, in the value of the property-equivalent to $2,000 each year, or two per cent annually on the original cost. In other words, a valuation made at the end of the said five years, resulting in revised rates being fixed on an estimated reproduction theory, capitalizes an unearned increment and automatically results in rendering a nine-per cent rate-of-return throughout the entire first five year period. What has the utility done or denied to itself in order to deserve this unearned increment? A fair and equitable return has been paid each year to the utility owners on their *entire* and *complete* investment, and an equitable fund has been set aside concurrently for the purpose of replacing the property when it ceases to be used and useful for public convenience. Is not the public entitled to participate somewhat in the appreciation of property, at least to the extent of not having the same capitalized against it, to be borne by the rate-payers of the future? Carrying the illustration still further, let it be assumed that the estimated reproduction value sinks to $90,000 at the end of five years; then the reverse is true, and the utility each year is deprived of just earnings equivalent to two per cent of the cost of the property. Under such conditions, would it not then be argued that this deprivation of earnings would constitute a confiscation of property (a constitutional invasion of property rights)?

Such illustrations are indicative of the general public's vital interest in what is termed "appreciation." It should be borne in mind that "depreciation," as applied in valuation work, in no manner is the opposite of "appreciation." An original-cost valuation, if properly compiled, does not presume to inflict upon a public utility the losses occasioned by decreases in prices of material and labor. An original-cost valuation, however, does presume to reflect the conditions under which the bargain between a utility and its consummers was consummated. Under

an original-cost valuation, the public sustains all losses due to the falling off of prices, although it participates in gains only to the extent of not having an unearned increment capitalized against it.

The Massachusetts Public Service Commission, in its recent decision rendered In Re Bay State Street Railway Company (August 31, 1916), squarely recognizes that appreciation in land as disclosed by a reproduction method of valuing the same is not to receive elaborate recognition in a determination of rates:

"Considering this appreciation upon its own merits, car riders cannot fairly be expected to pay higher fares because land has increased in value, nor ought they to pay lower fares if it should decrease. If the company wishes to sell such property it is, of course, entitled to whatever profit it is able to make; but so long as land is employed in the street railway business it is dedicated to a public use and held subject to the conditions fairly attaching to such use. As the Commission has said in another connection (see House Document No. 1900 of the current year, pp. 88, 89): 'While no fair-minded man will deny that those who put their money into public service by building railroads are entitled to the opportunity to earn a fair reward, and this reward is to be determined, so long as their property is devoted to public use, not by investment or by service rendered, but in large measure by the rapid expansion of real estate prices in the larger centers of population, is contrary to sound public policy. It would mean that communities would be penalized by their own growth, and would lose all advantage from the fact that their transportation facilities were created in due season under favorable economic conditions.' It should be added that, even if the doctrine of present worth were accepted, the figure to be used in rate making would clearly be present worth for street railway purposes. In this case no evidence whatever has been submitted that the land has increased in value for such purposes."

It would seem, therefore, that engineers as a whole may well listen to the admonitions of the courts, instead of becoming partisan advocates of some theory or another. Such biased acts on the part of the engineering profession are accountable for rebukes of a type such as was administered forcibly by Judge Smith McPherson of Iowa, who, it is claimed, made a grievous error in the Missouri Rate Case (168 Fed. 317), by apparently

* 10 Rate Research, pp. 120, 121.

giving too great weight to testimony relating to certain new theories advanced by experts. In one of his last opinions, this caustic Iowa jurist called attention to the great danger of experts. Judge McPherson's life was largely behind him, and he had had more than his fair share of experience as a United States district judge in endeavoring to weigh the evidence of many an expert in various public-service cases, when he said in the Des Moines Gas Case (199 Fed. 205):

"Too often we have selfish, partisan, prejudiced, and unreliable experts engaged for weeks at a time at $100 or more and expenses per day, exaggerating their importance and making the successful party in fact a loser."

FINANCE FOR ENGINEERS

ALLAN LEE, g '04
Assistant City Editor, Wall Street Journal, New York City

It is admitted by those who know that the engineering profession does not ordinarily pay very high salaries. Statistics show this, but it certainly is no reflection on the profession; rather does it indicate that engineering, from the viewpoint of remuneration, finds its own level among the other professions and in so doing points to that which is better paid—that is, finance. There is a reason for everything if it can only be found. The engineering profession is essentially one of public service, and engineers themselves as a consequence are apt to be viewed as public servants. It would be thought that public service is the highest ideal for business and should therefore be correspondingly compensated. That engineering is not so compensated is explained by the fact that it does not initiate this service. Finance does this. It follows that engineering is virtually the servant of finance, and such it is considered generally *by financiers.*

Finance in the best sense is the motive power of all business. In every kind of endeavor it is the creative that draws the biggest rewards—the greater vision of possibilities and new ideas; it deals almost entirely with creative, constructive business ideas; it finds and makes opportunities for new business; and engineering afterwards puts these ideas into practice. This is pre-eminently the domain of finance.

The engineer may build a wonderful power plant, equipped with the latest and biggest turbo-generators, transformers, and transmission lines, and yet it may not pay. Financiers, on the other hand, make reasonably certain that such a plant will pay before the engineers are allowed to proceed with construction, or even design. In the last analysis who deserves the greater compensation? The financiers. Yet it may be said that they ask too much for their services at the present time. They are in a position to do so, and many Wall Street men are not sufficiently scrupulous to base their dealings on principle without yielding to the obvious temptations which so much financial power places before them.

Where does all this touch the engineer? Does it not point to the need of his acquiring some knowledge of finance? Armour once said, "Get the education that gets the money." Not that getting money is the whole life, but to a very large extent a man is the arbiter of his own destiny. He is at liberty to choose the more lucrative profession. All may not be leaders in business thought and those minds which are capable of rising will do so irresistibly. For others, pointing out the path is the best that can be done. There will always be engineers, but engineer-financiers are the great need of the present and future. It is said that the demand for public utility enterprises during the next five years will require $2,000,000,000 of capital, and while it will probably be impossible to raise this vast sum for this special purpose because there is not enough capital to go around, it nevertheless indicates the immense possibilities of engineering finance. Are the engineers up on their toes? This is their legitimate field if they only realize it, and it will not do for them to lose these prizes to others. Who knows but that the expert mind of an engineer, when trained to finance might leave the present day promoters far in the rear?

No one is more in love with his profession than the engineer. With his natural aptitude for figures and experimentation it is no wonder that the laws of applied mechanics are his very element. Very largely engineers are such by choice. They have selected this occupation because it is the one most attractive to them. But right here lies a great danger. Engineers have been charged with narrowness. They are like the student at the concert with his head in the air apparently enjoying the music who, when asked by his fair partner the reason for his rapture, replied, "I was studying the roof stresses."

It is the writer's hope that a course in elementary finance at least may be made an indispensable part of the engineer's training. A little lucid teaching on this subject goes a very long way. It is not easy; terminology stands in the way and there is apparently little present opportunity to demonstrate one's knowledge. The writer remembers how long it took him to derive a clear distinction between bondholders and stockholders. The former are the creditors of a concern who have loaned it money at interest, while the latter are owners of the company.

Both stock and bonds are carried on the balance sheet as liabilities, but bond interest must be paid, while dividends on the stock may be passed.

Next best to courses in the University is to come to New York in vacations and to register with some of the summer schools in the financial district. The National City Bank has one such institution especially for college men, training them for its foreign branches. The Standard Oil schools are well known, while many of the trust companies also provide systematic instruction in banking and finance. The existence of these schools demonstrates the degree of importance with which these institutions regard specialized training and how impossible it is at the present time to obtain this training outside the walls of those companies which are going all the way to bring men to the point where they will be able to carry on the intricate responsibilities of modern business.

These pointers are the result of the writer's own personal experiences and observations. I am a believer in efficency in the matter of careers. I knocked around the world considerably before I found the right place, spent a number of years in Europe, taught school a few years and finally landed up as a writer on the *Wall Street Journal.* Reviewing my past experience I can honestly say that of the things which I could reasonably do, Wall Street Journal experience has opened up bigger possibilities for the future, with greater opportunities for becoming eventually independent, than any other work I might have taken up. We are in the full current of the world's finance down here with abundant opportunity for acquiring the first hand knowledge that writing about big business provides. Wisconsin is well represented in Wall Street, and by engineers especially. Our Alma Mater is greatly respected in the business world.

The Wall Street Journal is a chronicle of big business. To read it consistently for six months would be an education in finance itself. Its reporters are all specialists on the different companies, that is, one man may be responsible for all news development for certain railroads, is expected to know all the directors, and generally to be as much on the inside as possible. Other men may be responsible for industrial companies or public utilities. My work is in the bond department. A head for fig-

ures is invaluable here as bond articles frequently require some astute mathematical reasoning. Bonds may be said to be the foundation of finance. The field is unlimited. Financing of the war is carried on by bonds, and unexpected developments in bond finance are constantly coming up.

All projects are first done in the mind and this explains why new ideas are more rewarded than mere execution. It is because engineering has to do primarily with physics that I want to point out this pitfall. Let the engineers realize that engineering is a servant, so as to combine service with mastery by becoming engineer-financiers. The world is in need of them.

THE 1916 EASTERN INSPECTION TRIP

Senior electricals and mechanicals still retain pleasant memories of the inspection trip of 1916. Under the careful tutelage of "Bob" Disque, "Bill" Black, and the burlesque twins, "Turp" McLean and "Leak" Kelso, seventy-one seniors demonstrated very well that they contained at least the average amount of engineering pep. Although the trip proper was not scheduled to begin until 12:05 Saturday morning, most of the boys were running an efficiency test on Chicago early Friday afternoon, and it is for this reason that roll call was answered by about seventy-one snores of as many tones and character.

Upon arriving in Detroit, which was our first real stop, we were bundled into real class, namely, Twin Six Packards, and taken out for an inspection of the Packard plant. Mr. R. T. Herdegen, '06, who led the procession in a "Henry," next escorted us to the Ford factory, which proved of immense interest to all. Here excellent chances were offered for a comparison of quantity and quality production, improved labor devices and remarkable organization. Our next spurt carried us to the Connors's Creek plant of the Detroit Edison Company. Owing to the courtesy of good guides, this proved to be very interesting and gave us a chance to see efficiency of the highest calibre. The evening was spent at the Detroit Athletic Club as guests of the Wisconsin alumni, who offered us every possible form of hospitality.

All Sunday was spent in sight-seeing at Niagara Falls and the islands in the vicinity. As Niagara Falls has the lid on Sunday, the Gorge trip was enjoyed in the afternoon, while the evening was spent in vaudevilles and letter writing. Monday morning's work included first an inspection of the plant of the Hydraulic Power Company, where several turbines of the Parsons or Francis types attain large proportions and the maze of electrical equipment sets one dizzy, and then to the W. A. Rogers Ltd., and United States Heat and Light Corporation plants, which also proved of great interest. After luncheon the trip continued to the Carborundum Company and the International Acheson Graphite Company. At these places we were able to watch the entire process of manufacture from the intro-

duction of the raw material to the finished product. We then inspected the Niagara Power Company and the International Paper Company, the latter of which remains to date as a somewhat hazy recollection in my mind. Before leaving for Buffalo we were royally entertained at the Shredded Wheat Biscuit Company. On this particular ride to Buffalo our celebrated agony dispensers, Van Patten, Porter, Wadsworth, Gregson, Kelty, Grant, and Nelson proved very pleasing to several of the fairer sex, and as a result they spent the evening elsewhere.

Hotel Statler service proved very satisfactory, so much so that it was with much hesitancy that the trip was resumed the next morning. The Mechanicals visited the Wheats Ice Cream Company, being welcomed, chilled, frozen and fed there while the Electricals were visiting the Automatic Telephone Exchange. The Buffalo General Electric Company and the Curtiss Aeroplane factories were next visited and given a most careful inspection, as were the Pierce Arrow Motor Car Company and the Aluminum Castings Company. It was after inspecting the aeroplane works that our photographers lost their stand-in with the bunch by failing to snap "Bob" Disque as he issued from a "Milwaukee famous" emporium, which he had presumably entered to use the telephone.*

Next morning found us eating at the hospitality of the A. M. Byers Company of Pittsburg. Here the puddling process of making steel was carefully followed and the progressive steps in the manufacture of pipe were noted as well. This was followed by a trip to the Mesta Machine Company where castings of immense size were to be seen in the process of manufacture. The National Tube Works proved to be very interesting, especially to those who with Kelso voted to remain behind at the Mesta Works. A most enjoyable evening was spent at the Fort Pitt Hotel, where "Willie Steinmetz" Wertheim and "Crowbar" Wood waxed eloquent and insisted upon interviewing several of the movie queens of the city thereafter.

* Editor's Note: It is a very interesting phenomenon to note that out of the two hundred successful photographs taken on this trip that this one alone should have been a failure. For further information, inquire of the above mentioned party.

Along with George Andrae '16 and Eddie Andrews '16 we visited the Westinghouse plants on the following morning and passed an endurance test of a ten mile hike through the W. E. & M. Company that afternoon. The troubles of the entire trip were repaid in full by what we saw here and later in the burlesque show which we attended that evening en masse.

Upon arriving in Cleveland the next morning, we found M. D. Cooper '08 and his brother alumni of this city waiting for us at the station. After a fifty cent toast and coffee steal at a lunch counter, we were escorted to the Willard Storage Battery Company and later to Nela Park. The manufacture of storage batteries was very carefully explained to us and proved to be very interesting, as did the latest experimental results of tests demonstrated at the lamp works at Nela Park. The actual lamp making process, however, was not disclosed. The afternoon was spent visiting the National Carbon Works, the American Steel & Wire Company and the National Welding Company, at each of which plants things of very great interest were always to be found. Due to the efforts of the Wisconsin alumni the evening was spent in a most enjoyable manner at the University Club banquet.

The last morning of the trip was spent in inspecting the blast furnaces and rolling mills at Gary, Indiana. It should be said in closing that the trip proved to be of great educational value and that it undoubtedly served to strengthen the bonds of friendship between us all. Those who went on this trip will probably never forget the ever present Wisconsin spirit so often renewed and asserted on each and every possible occasion throughout the trip.

TEST OF ECONOMY AND EFFICIENCY OF AUTOMATIC TEMPERATURE REGULATION IN OFFICE BUILDINGS

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Editor's Note:—The interesting results of this test appeared originally in *The Heating and Ventilating Magazine.* They have been reprinted owing to the fact that the same system of heat control is applied in the buildings of this University.

In making a test of economy and efficiency of the automatic temperature regulation in office buildings, a room was selected on the third floor of the Rialto Building of Kansas City, Missouri. Heat was supplied to the room by an overhead distribution single pipe, air line vacuum steam system, using a radiator of about 45 square feet area. In making the test it was desired to know just how often the diaphragm radiator valve was opened, how long it remained open during each operation, and also how closely the temperature was kept to the desired degree by the operation of the thermostat. To obtain these data, a Bristol recording thermometer and a Bristol recording pressure gauge were used, the latter being connected to the air line leading from the thermostat to the diaphragm radiator valve. Thus when the thermostat operated, air pressure would be thrown from the main air supply into the branch air line leading to the valve and would be recorded graphically on the pressure gauge chart, giving a continuous record of the operation of the diaphragm valve.

This diaphragm valve is operated by compressed air and is so arranged that when air pressure is thrown on the diaphragm, it is forced downward. As this diaphragm bears directly upon the valve piston, it forces it downward and thus shuts off the steam supply to the radiator. When the air pressure is released, a spring forces up the diaphragm, and the valve is automatically opened. The thermostat is so arranged as to turn this compressed air into the branch leading to the diaphragm radiator valve or to release it from the same at slight temperature variations (from a half to one degree). When air is admitted at the top it forces the diaphragm down, as can

be seen by noting the valve construction in the accompanying illustration (Figure 1). The thermostat used was of the positive type, and this instrument is so arranged that when the diaphragm valve is closed the full air pressure of 15 pounds is thrown on the diaphragm. When this pressure is released, it is released entirely, the pressure dropping to zero; the valve, therefore, is either in a fully open or a tightly closed position.

The test was started early in February, the coldest weather experienced during the test being on February 12, when the temperature varied from 11 degrees F. to 29 degrees F. This

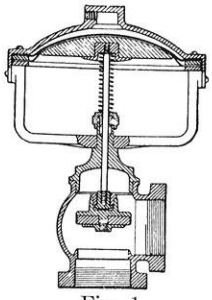

Fig. 1

Fig. 2

may be considered as severe winter weather for Kansas City and is somewhat colder than the average winter day.

The two charts for February 12 shown herewith (Figure 3) should be studied together as they are inter-related, the room temperature varying, of course, as the diaphragm valve is opened and closed by varying pressures. On the recording thermometer chart the outside temperatures obtained from U. S. Government Weather Bureau, located directly across the street from the Rialto Building, are shown by dotted lines. The slight variations in the air pressure on the recording pressure gauge chart (variations between 14½ and 15 pounds, making a slightly waving line) were caused by the operation of the automatic air compressor which operated about once in 15 minutes.

From an inspection of the recording thermometer chart it will be noticed that the outside temperature was 29 degrees at 6:00 P. M., went down steadily to 11 degrees at about 8:00 A. M. and was about 20 degrees above zero at 6:00 P. M., an average of about 19.5 degrees F. for the 24-hour period. During this period, the indoor temperature was maintained between 70.5 de-

grees and 72.5 degrees F., being raised a little more than 50 degrees above the average outdoor temperature.

The pressure chart shows the thermostat operated 32 times, opening and closing the valve at 16 different short intervals. In fact, the valve was held open only from five to 10 minutes at a

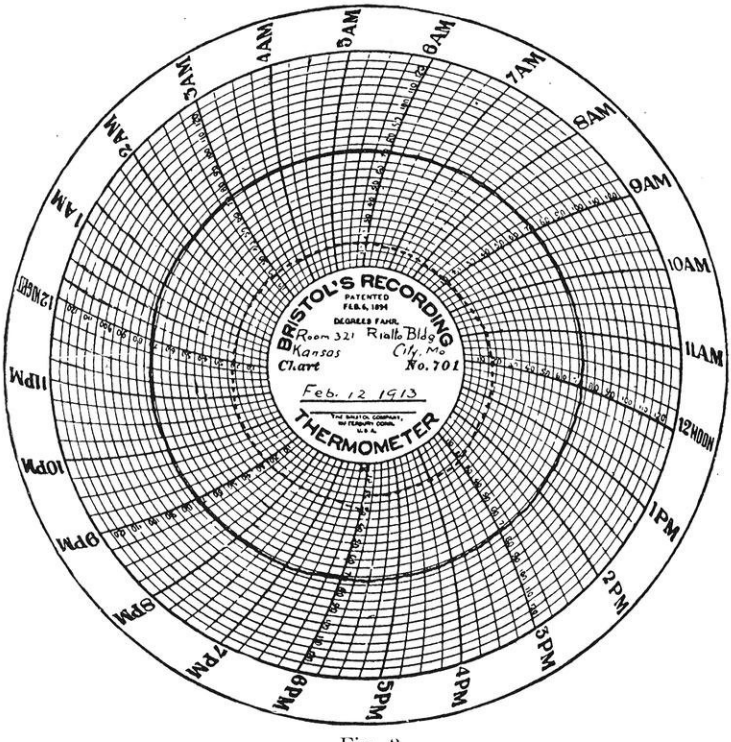

Fig. 3

time, for a total of approximately two hours out of the entire 24, or about eight per cent of the time. It will be observed that the indoor fluctuations of the temperature follow the valve operations very closely, lagging a little behind same, as would be expected.

For instance, it will be observed on the recording thermometer chart between 12:00 noon and 1:00 P. M. the temperature gradually fell from about 72 degrees until just about 1:00 P. M. it almost reached 70 degrees. By now referring to the recording pressure chart, it will be noted that at about 12:55 the thermo-

stat operated, releasing the air pressure (which dropped at once to zero) thus permitting the valve to open and to turn heat into the radiator. Within 10 minutes the room temperature had risen to almost 71 degrees, and as is evident this slight increase of less than one degree was sufficient to cause the thermostat to

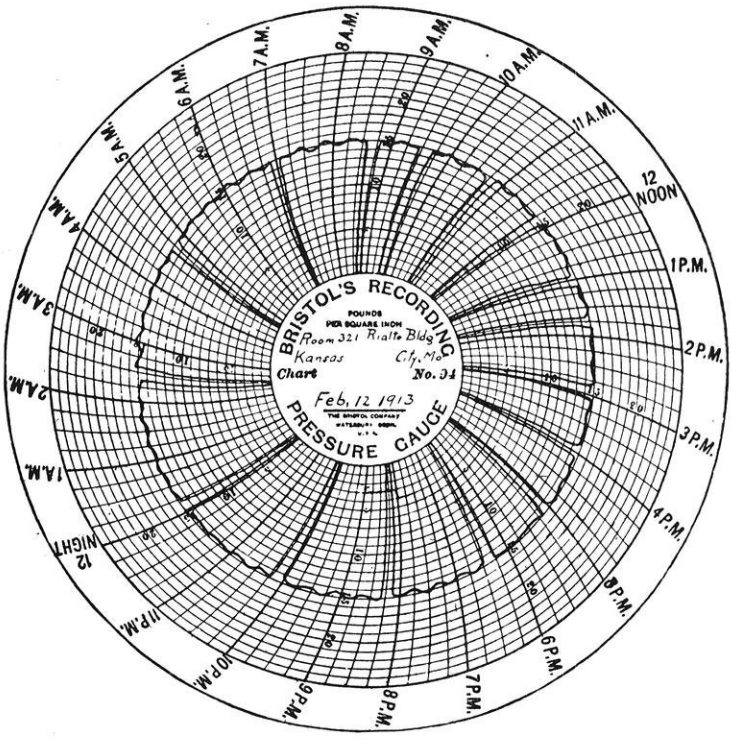

Fig. 4

close the valve and to cause a rise of 15 pounds pressure on the pressure recording chart. The temperature, however, still rose another fraction of a degree due to the fact that, although the steam was shut off, the radiator was still hot enough to radiate heat for a brief interval of time.

At 1:15 P. M. the temperature again began to fall slightly; at 1:37 P. M. the thermostat operated to let in more steam and closed at 1:47 P. M. The temperature increased slightly, however, for only a few minutes when it began to fall once more, the thermostat operating once more at about 2:50 P. M. In each

case the thermostat operated on less than one degree variation in the room temperature. As would be expected it operated more frequently while the outdoor temperature was around 10 degrees to 15 degrees than it did during the time the outdoor temperature varied between 20 degrees and 30 degrees.

The charts for February 12 were selected from the others simply for the reason that this was the coldest day encountered. The tests were not begun until February 12 and the weather moderated so much after the 23d that it was decided to stop the tests, as little new information could then be derived.

The results of these tests show that in order to maintain a uniform temperature in a room heated with direct radiation, it would be necessary to open and close the radiator valve from 10 to 30 times a day. The room occupant will not bother himself with this task and in general will permit the temperature to get so high as to become noticeable and will then resort to opening the windows for relief without turning off the radiator valves. Where automatic temperature control is used, the valve is opened and closed frequently, maintaining the room at the desired temperature without any attention from the room occupant. It is known that automatic control is very conducive to great fuel economy and will result in a saving in fuel from 15 to 40 per cent.

ALUMNI LETTERS

TEN YEARS OUT

W. H. SACKET, c '06

Engineer, Sacket & Davis, Engineers & Contractors, Madison, Wisconsin

STARTING IN BUSINESS FOR ONE'S SELF

Ten years ago this last June I left the University with my diploma in my pocket, gladness and sorrow both in my heart, and a few world-setting-afire ideas in my head. After a few days of vacation at home I left for Miles City, Montana, where I entered the employ of the C., M. & St. P. Ry. Co., who were then building their western extension into the Northwest. I was located in a camp thirty miles west of this city until March, 1907, when I was transferred to Seattle and sent out with a party on preliminary location through the Quinault Indian Reservation and the Government Forest Reserve. In December of that year, the panic was felt quite keenly, and it was rumored that several of the field parties were to be discontinued; Christmas, too, was in the air, and instead of the "Call of the Wild," we heard the call of civilization; so three of us "hit the back trail" and returned to Chicago and home.

The following March, 1908, I accepted a position with the Board of Supervising Engineers in Chicago; August of the next year found me superintendent of a large granite quarry in North Carolina, which position I retained until December, 1910; I then resigned and returned to Madison where I "set up shop" and hung out my shingle. Here the struggle began in real earnest. Up to this time I had always received my check at regular "ghost walking" intervals; then, too, I figured I was entitled to a vacation occasionally, but from now on these vacations assumed an entirely different aspect, and my acquaintance with the "ghost walk" became very formal; in fact, there were times when it ceased entirely, while at others friend ghost fairly ran. Gradually the old relations were established and became very friendly and informal once more.

A young engineer whose living depends entirely upon his work ought, if possible, to start in for himself as the junior member of some established engineering or contracting firm even though his pay be only enough to cover living expenses for a year or more. In this way he not only will get an intimate knowledge of how work is actually handled both in the office and the field, but it will give him confidence in his own ability to take charge of such work. He will, therefore, arrive much earlier in his career at the point where he will be able to start out alone and feel he is on equal footing with his competitors.

The past ten years have proved that the civil engineers of the class of '06 were made of the right stuff, for practically all of them have "made good." There are a few of that old "drafting room bunch" whom I have lost track of, and if this letter comes to their attention I would like to hear from them. "Butch" Moser, "Pa" Lawrence, Eddie Wild, Billie Rath (The White Rat), and Fred Youngblut. Now fellows, if you are too busy to write a letter, send a card with your name and address. Address it to me at Madison.

NINE YEARS OUT

S. L. Clark, c '07

EXPERIENCES IN THE CANADIAN NORTHWEST

My own experiences I fear have been rather commonplace. In our senior year, Fred Cary, Fred Ebert, and I decided that we should go into the great Canadian Northwest. Ebert and I secured jobs with the Canadian Pacific Railroad as topographers in a preliminary party near Prince Albert, Saskatchewan. Cary worked in a construction camp for the Canadian Northern near Edmonton, Alberta. Living in a tent all winter, moving on an average of once a week and working in weather from twenty to forty degrees below zero is fascinating, more fascinating, however, to look back upon than it is to experience. Finally in March I had both hands and one ear frozen, so I returned to the States thinking that I was unlucky, but considering what has since happened to Cary who stayed, I have changed my mind.

A year and a half ago I visited Cary for six weeks; at that time he was living on an island near Vancouver Island,

British Columbia, about a day's boat ride from either Vancouver or Victoria. Those in our class may recall that Cary was a veteran of both the Boer and the Spanish-American Wars. For a year he had withstood the call for recruits in the present war, but while I was there he was offered a position as lieutenant in the 67th Battalion—the Western Scots. I tried to persuade him to come back to the States but he said that he had earned his living in Canada for eight years and that he felt it his duty to do his share for Canada. Nearly a year ago he went abroad. Twice he has been promoted, until now he is a major. The last I heard of him was that while fighting near the Somme front, last November 19, he had been wounded. How seriously wounded he was I do not know, but he was in a hospital near Boulogne, France, for some time. If any of his old friends should chance to read this and care to write him, address the letter to London, England, care of the 67th Battalion, Canadian Expeditionary Forces. Although I would prefer to have him tell his own story, he is rather busy just now; no doubt he will have plenty to tell about anyway.

Well, after I went back to work, I draughted awhile and then started to inspect bridges for the C., M. & St. P. Ry. I did this for about three years until my wife, who had then refused to worry about me any more, said that either I must resign my position or she would; so I am now on a very tame job. Possibly if I am asked again to write, I shall be able to tell you about some of the occasions on which my light gasoline inspection car ran off the track, how interesting it is to meet a train on a curve, and how exciting it is just to have time enough to get off yourself and to watch your car and a train try to pass on a single track road.

EIGHT YEARS OUT

W. G. Gibson, e '08
Engineer, Flannery Bolt Co., Bridgeville, Pa.

CONTENTMENT IN ONE'S WORK

Eight years out—how tempus does fugit! It really is enough to make one feel rather ancient, especially in the presence of a '16 man; but then sometimes, when I see here in Pittsburg a certain well known patent attorney who received his little bit of parchment two months before anyone knew whether I was to

grow up to be an engineer or a mother, there comes a realization that a man may live and add year after year to his life and yet may not grow old. Although this man's hair is white and we naturally call him "Dad," of all the members of the local Wisconsin Club he is the youngest and I believe that he is young because he has found contentment in his work.

It is eminently proper to gage one's age as an alumnus by the number of years that one has been out and to relish a certain amount of satisfaction in being an 'old grad', but there all talk of age should cease. Old age is the wage of discontent, and the man who has found contentment in his work is the one who is going to be young when his contemporaries are fit subjects for the old folk's home.

The proper choice of one's employment is the most important factor to contentment. Some men find theirs in the employ of a large corporation—and many of them make good. For my part I have tried both. For fourteen months after leaving school I did my best to be happy as one of the atoms of an eastern railroad organization, until discontent that could not be changed prompted me to change. Today marks the close of the first quarter of my eighth year with a manufacturing plant, the payroll of which has never carried more than three hundred names. My salary is not beyond the dreams of avarice, but I like my work and I respect—and have the respect of—my employer. Is there any thing more necessary for contentment?

SEVEN YEARS OUT

W. P. ZABEL, e '09

Engineer, National Lamp Works, Nela Park, East Cleveland, Ohio

ESSENTIALS FOR SUCCESS

From the time of my graduation, I have been in the employ of two large corporations, as an apprentice to a concern manufacturing electrical machinery and prime movers, and later with a well-known incandescent lamp works in Cleveland. I have now been connected with the engineering, manufacturing, and experimental departments of the latter concern for more than six years.

From past experience and observations the writer has formed several opinions regarding the necessary characteristics of the successful college graduate. The most successful business

men and engineers are generally those who possess highly developed intellects and personalities. The secret of their success seems to be due largely to their ability to "mix" well with all of their fellowmen. They have a good command of the English language, are quick and forceful in their speech, and avail themselves of every opportunity to gain publicity. The education of these successful men is general, and they are familiar with all modern progress. Their judgments are keen and comprehensive in both large and small problems. They are leaders in every sense of the word.

It is the belief of the writer that many of the above qualifications for success can be acquired by the student while attending college. There is little doubt that such courses as English, public speaking, business administration, economics, and psychology could profitably be included in the curriculum of every engineer. The first two subjects in particular would be well worth four years of study. Attention should also be given to development of the body and to the improvement of personality. The student should be a good "mixer." The facilities offered at Wisconsin for such personal and social betterment are numerous and too well-known to need mentioning.

In conclusion, the writer would offer as advice to engineering students that they generalize instead of specialize in their courses of study and that they develop personality and self-reliance to the greatest extent before entering the finishing school known as the business world.

SIX YEARS OUT

K. E. WAGNER, c '10
Sales Manager, Barton Spider Web System, Chicago, Illinois

GROWING IMPORTANCE OF COMMERCIAL ENGINEERING

Writing to a non-subscriber to the ENGINEER for a news contribution is much like the trick that our local alumni unwittingly played on an alumnus—a non-member of the club—when they appointed him to the membership committee. He joined the club at once and has since been an enthusiastic member. I'll say that this was good salesmanship.

I shall have to omit family news, as thus far I have neither wife nor child. My work at present consists in managing the sales department of a small but growing organization, specializ-

ing in that type of reinforced concrete design known as "flat slab construction." We usually operate as contractors for reinforcing steel, taking our fee in the form of a percentage of the steel. We are accordingly commercial engineers, that crew accursed in the eyes of many purely professional men who say that we subordinate all professional ethics and designing standards to mere job getting. Of course there are black sheep in every flock, but I am convinced that our own organization is its own hardest taskmaster in the matter of fitting a sound and economical design to the owner's requirements. After all that is true engineering.

Of late engineering has associated itself more closely with business because it deals so intimately with our economic life. If the writer had something to say about the engineering curriculum of his Alma Mater, he would substitute for some of the junior and senior electives a strong course in economics and banking and a stiff course in the use of the English language.

FIVE YEARS OUT

J. F. ALEXANDER, e '11
Sales Engineer, Air Reduction Sales Company, New York

KNOW THYSELF

Your letter requesting a literary contribution to the WISCONSIN ENGINEER was received with great pleasure, not on account of the honor it bestowed on me (this is appreciated) but because it conveyed a message from a place associated with some of the dearest remembrances of my life. True, the cons and flunks loomed up as unforgettable disgraces, but the passes, (not to ball games) but to the next semester, soon put these in the background.

You ask for a letter on "experience, observation, advice, suggestions or anything of interest to students or alumni." I am not in a position to give advice and my experiences might not prove interesting to the majority, but I am disposed to suggest a few ideas by the following questions:

1. Is it necessary to determine your future by the first position you obtain?

2. Is it necessary it hold on regardless of your qualifications for that particular kind of work?

3. Do you know enough about yourself to determine what you are best suited to do?

4. Is it not possible that there is another kind of work better suited to you than the one you chose at random because some one else has succeeded in it?

The importance of knowing one's self cannot be overestimated. A very successful man in New York, the general manager of a large company said to me one day, "A man will always succeed if he knows himself and his competitors." I am reminded of a great many very bright young graduates in the wrong line of work. It is for this reason that I have suggested what is implied in these questions. Do not get the impression that I advocate jumping from one position to another. I do not. But I do advise you to study yourself very carefully, find your particular kind of work and then stick to it through thick and thin.

You are all invited to come and see the largest oxygen producing plant in the United States; we are operating it here.

FOUR YEARS OUT

H. M. DOERSCHUK, e '12

Electrical Superintendent, Aluminum Company of America, Niagara Falls, New York

IMPORTANCE OF DETAILS

After finishing my school work, I started work in the testing department of the General Electric Company at Schenectady, New York. The experience that I gained here was very valuable because it helped me to put into concrete form much of the fundamental work received in school. Having an opportunity at the end of eight months to take up electrical work with the Aluminum Company of America at Niagara Falls, I journeyed to the "Power City" and started work in the operating department. Recently I have become electrical superintendent.

In the electrolytic process for the reduction of metallic aluminum, a large quantity of direct current power is required which must be supplied continuously and at a constant rate. One of the things of great importance in this work is the care and maintenance of direct current commutating machines. In this work the importance of attention to details, accurate and extensive study of each commutator and its brushes in both an electrical

and mechanical manner is brought out very forcibly. Each machine has its individual set of characteristics, even one machine from its duplicate in design.

On several of the water driven generators here, the positive brushes on one commutator are on one side of the armature whereas the negative brushes are placed upon another commutator on the other side of the armature. Those used on the positive side are Speer grade H–8, and those used on the negative side are National grade 255–G. The former have a much higher specific resistance and greater hardness. It has been found impossible to use the same brush on both commutators. This is no doubt due to an action which is supposed to be similar to electrolysis while the machine is under load. In the case of the negative commutator, deposition is from the brush to the copper, giving the commutator a slight coating and a glazed surface; in the case of the positive commutator, deposition is from the copper to the brush and gives the brush a tendency to pick up copper, to carry excessive load, and to give the commutator a raw surface. Were it not for the hardness and therefore the abrasiveness of the brush which causes the mica to wear away at a rate equal to that of the copper, this picking up of the copper from the commutator would cause the flush mica to stand up above the copper. Thus, when a brush has picked up considerable copper, the current in it is greater due to its lowered resistance relative to those brushes without the copper, selective commutation occurs and any excess solder on the brush pigtail generally melts off and drops on the commutator thus causing excessive flashing or the fusing off of the entire pigtail.

There are a great many other details which I might add, but these are sufficient to show how much depends upon attention to details, the large scope of useful study along this particular development, and the necessity for good ground work at school.

THREE YEARS OUT

R. L. DODD, e '13
Engineer, T. M. E. R. & L. Co., Milwaukee, Wisconsin

OPPORTUNITIES IN DISTRIBUTION ENGINEERING

When asked to write something for the WISCONSIN ENGINEER I felt somewhat as "Mood" Oehler—that I was hardly qualified in three years to send back very much advice. However I shall say something about my own particular field which may interest some of the undergraduates in the central station business. I believe that too few Wisconsin men have been entering this field after graduation.

My start with a large operating company was as a ground man with a line crew. I gained more experience as a timekeeper on transmission line and then entered the distribution engineering division. There has been a remarkable increase in business in the last three years. The advent of the gas filled incandescent lamp stimulated and completely changed outdoor illumination. Electric ranges in large numbers are being installed, introducing new problems in the distribution of energy and increasing the load density. I have been privileged to assist in the connection of transmission and distribution lines in six or seven counties and in a considerable number of communities. Apparently there is no limit to the fields that are now open to us. Electric service is rapidly becoming universal in the rural as well as the city districts, and it will not be many years before each accessible village and all the farms between will be supplied from transmission networks.

For the young engineer who likes outdoor work and who is interested in increasing human enjoyment and efficiency by the introduction of electric light and power, the spreading of the transmission line development and service offers a most interesting field. I am glad to say that our own distribution engineering staff has increased from three to seven in three years, and that four of them are Wisconsin men. My experience has been that among the electives offered to engineering students, the conference or the seminary course gives the student much needed experience which becomes more and more valuable as they advance in their profession.

TWO YEARS OUT

BERRY THANE STEVENS, m '14
Chemist, United States Steel Company, Gary, Indiana

THE ADVANTAGE OF SUMMER EXPERIENCE

A man "two years out" is hardly in a position to give any counsel to an undergraduate regarding the proper way to make a success in the engineering world. However, I can relate my small share of experiences since graduating and possibly offer one or two suggestions.

It was my ill luck to have the European war start the same summer that I graduated, and so for the first six months my experience in the business world did not amount to very much; in fact, as I remember, it consisted mostly of applications and interviews. In the following spring I was offered a position as a chemist with the Illinois Steel Company, Gary, Indiana, and I accepted even though I had studied mechanical engineering. When my class made an inspection of the Gary Steel Works during their senior year little did I imagine that I would be working there less than a year later. There must have been something prophetic in the fact that Professor Christie, upon our return from the inspection trip, assigned to me the Illinois Steel Company as my plant to report upon. I can only say that I consider the knowledge and information I have obtained during my business experience of a year and a half not only of the manufacture of iron and steel but also of business practice in general will be of immense value to me in any engineering work that I might possibly enter into later on.

Engineering is so ramified that it is seldom a graduate knows the exact kind of work for which he is best fitted. As a result he generally spends his first two or three years out of college in determining the specific phase in which he can make the best success. And so my one suggestion for a student in engineering is to use his summer vacations to the best advantage in finding out to just what he is best adapted so that after graduation he can start on the road to success without having to "relocate" too many times.

ONE YEAR OUT

LESTER C. ROGERS, c '15
Engineer, Bates & Rogers Construction Company, Chicago, Illinois

LEADERSHIP OF COLLEGE GRADUATES

Believe me, it did my heart good to find unexpectedly a bunch of Wisconsin engineers hurriedly downing their coffee and rolls across the lunch counter from me in Pittsburg a few weeks ago. From June, 1915 to early in October, 1916, I hung up my hat each night in a little tar-papered shack in the heart of the Selkirks near Glacier, British Columbia. Hence you can believe I have seen very few Wisconsin people.

The work with which I was connected was the lining with reinforced concrete of about one and one-half miles of the Canadian Pacific Railway's Rogers Pass Tunnel. The tunnel is double-tracked, five miles long through rock, has a maximum overburden 6,300 feet in height, and is the longest railway tunnel in North America. The extreme cold and heavy snow, the limited working space in the tunnel, and the great distance underground at which concreting had to be done (two and one-half miles maximum) presented many difficult construction problems.

The minimum temperature during the winter was -33°, and take it from me that's *cold* when the wind is blowing a gale and your steam heat consists of a little, red-hot camp stove in the middle of a breezy shanty. The snow started falling late in September and our last flurry came the first day of the following June,—with a total fall of 35 feet. After a winter like that, December in Cleveland certainly seems most tropical.

There are two things I'd like to tell the fellows as as an "*Old* Grad" (get that "old"?). You have no idea of the position of leadership that a college graduate in the backwoods or in the city is supposed to and ought to fill; leadership not only in his own particular profession but in everything that is worth while in the community. Then second, a school is judged by the world at large by the men it turns out. We certainly want to see Wisconsin represented throughout the world by men with big hearts and big, keen, just minds who can fill their places of leadership in the world with honor and with credit to themselves and to the old school. Do you get the idea? (Copyright L. Kahlenberg.) Then here's luck to you!

JUST OUT

K. R. BURKE, ch '16
Engineer, American Tar Products Company, Carrolville, Wisconsin

SPIRIT OF COLLEGE GRADUATES

When asked to write a letter for The ENGINEER I was told that "anything in the nature of advice, suggestions, or observations" would be of interest. As a "Just Outer," however, I feel that it will be wiser for me to confine myself merely to the observations, or to the matter of advice, which has been imposed upon me. On leaving Madison last June, I was informed by the head of our department that he would like to hear from me during the following year. He laconically added that I could spare myself the trouble of writing until I had something to say, and until I had given up the feeling that of all our class I alone had picked a "rotten" job. I have not yet written him. However, this will serve as an advance notice that he is due to hear from me soon. He knew what he was talking about.

More advice was dispensed when I put in my appearance on the job. The greeting of the Superintendent was as follows: "Don't tell all you know. If you keep your eyes open and your mouth shut, your chance will come." That sounded pretty good to me, but I must admit that there were times when I sorely doubted the wisdom of it. For instance, on those scorching July days just past, when one was covered with tar and baking in the heat of the sun and a hotter tar-still, how could one keep his eyes open when they were sealed shut with creosote, or how could he keep his mouth shut as long as he was able to give vent to a few well placed and relieving "cuss-words"? He couldn't, and he didn't. So much for advice by others.

As to observations, the only one I can make at present is that I am more than ever impressed with the value of technical training, and proud that I am an engineering graduate. No! not because the "fledgling" engineer is proving that he is letter perfect in "the integral of" etc., but because of my observation of college graduates. There are five other recent engineering graduates here, one each from Cornell, Michigan, Purdue, Michigan and Illinois, and they all are imbued with the same spirit, that is, to take what is given them to do and carry it through to comple-

tion, in spite of all obstacles. It doesn't seem to make any difference whether the hours are long, the work arduous, or the conditions unfavorable, the job is undertaken cheerfully and is done in the best possible manner. If a man has gained no more than that spirit during his college course it seems to me that he has spent four years to very good advantage.

In conclusion I wish to thank you for this chance to relieve myself by "breaking into print." It has caused me to look back a little and to appreciate how soon one is apt to forget that well populated front "porch," Bob Connelly with his "slip-stick" batón, and the old, familiar "Three Cheers".

In next month's issue,
Developments in Aviation Engines,
By Allison F. H. Scott,
and
The Telephone in Mexico,
By T. G. Nee.

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EDITORIAL

Did you ever consider just what qualities are expected, just what abilities will bring greatest advancements, or just what specialized training you are taking at Wisconsin that will be demanded of you when you are seeking employment after graduation? Do you know that the statistics recently compiled by the

Society for the Promotion of Engineering Education from over six thousand active engineers in America show that technical knowledge is classified fifth in the order of requirements? Moreover, have you ever considered that eighty-seven per cent of all necessary qualifications demanded by these engineers are for character, leaving thirteen per cent for technical education?

Preeminently it is character that is demanded—qualifications relating to integrity, loyalty, leadership. These are the qualities universally demanded. These are the qualities which count for far more than Steam & Gas, or calculus, or E. E. It is your integrity that stands far above your knowledge of steam tables, solubility coefficients or your laboratory skill when you come to meet your future employer.

The question then arises: If this laboratory technique or this intricate and vast knowledge of scientific advancement and mechanical application are so incomparable to these other things, who is at fault for these deficiencies and how may they be rectified? If it is true that technical knowledge is fifth of all necessary requirements and technique, the all important technique, is classified as sixth, wherein may we derive these vastly superior qualities when we now spend hundreds of dollars every year for the development of a mere one-tenth of the absolute essentials?

If you have been following the alumni letters in the last two or three issues of THE WISCONSIN ENGINEER you will have observed that the cry of the graduate—especially the graduate five or more years out—is for the development of more English courses for engineers and for the requirement of economics, banking, political economy, public speaking, and even philosophy in the engineering curriculum. The old cry is that engineering courses are too narrow, too specialized, and that they develop mere shallowness in the graduate.

This matter of our national educational system is a matter of paramount importance. Give it a moment's consideration.

* * *

Now comes the homestretch leading to the finals and the crucial part of the semester. Probably after the longer vacation that we have all enjoyed, we shall be able to do more efficient, more thorough better work during the next few weeks. Consistent work in the next few weeks—when there are but few

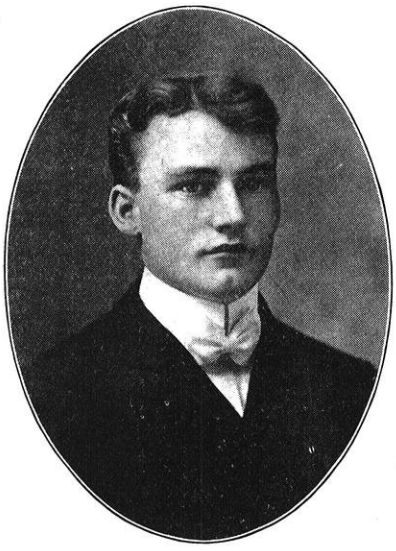
pleasant afternoons to tempt us out—will produce excellent results, will confirm many a good impression made in class, and will be beneficial even though the first part of the semester has been wasted.

* * *

ARTHUR JEREMIAH WALSH

December 22, 1885—August 28, 1916

Conspicuous on the list of Wisconsin engineers who have become prominent, not only because of their engineering ability, but because of their marked executive talent, is the name of Arthur J. Walsh, e '06. Upon entering New Richmond high school directly from the country schools, he soon showed his ability as a student, and later easily attained a high rank as a student here at the university. Shortly after graduation, he began work as an electrician with the Des Moines Gas and Light company of Des Moines, Iowa. About six years ago he moved to Kenosha, Wisconsin, and started work with the Kimball company as an electrician. He worked but a short time in this capacity when he was called into the office and made a member of the sales force. After the organization of the Wisconsin Gas and Electric Company he was made sales manager and later business manager, which position he held until the time of his death.



Mr. Walsh was noted for his keen business insight and for his high sense of personal honor. His position with the public utility company brought him into close relationship with many people of Kenosha and those who knew him best will most deeply feel his loss. No man in the employ of the company was more highly respected among his fellow workmen.

He had gained renown as a student of things electrical and was regarded as an expert by many men who have had much longer experience in this class of work.

Mr. Walsh was one of the leaders of the Knights of Columbus, and at the time of his death was esteemed loyal Knight of the Kenosha lodge. He was a member of the University of Wisconsin club of Chicago and was one of the organizers of the University club of Kenosha. His fraternal associations were of a most active nature and in all of the organizations he gave much to their success.

The death of Mr. Walsh has been keenly felt by his many friends for they realize the importance of the loss of this promising young engineer what it will mean to Kenosha and the University of Wisconsin in the years to come.

ARTHUR CLAYTON GREAVES
May 18, 1877—July 13, 1916

The many friends of Arthur C. Greaves, c '03, will be deeply grieved to hear of his drowning in Green Bay last July 13.

Mr. Greaves was born on May 8, 1877 at Glencoe, Minnesota. When six years of age his mother died and his father moved to Iowa, first to Manchester, later to Strawberry Point and in 1890 to Spencer, where Mr. Greaves graduated from the high school. After finishing high school he attended college at Mt. Vernon, Iowa until at the outbreak of the Spanish American War in 1898, he enlisted in Company K—57th Iowa Volunteers. Upon his honorable discharge from the army he entered the University of Wisconsin, from which institution he graduated as a civil engineer in 1903.

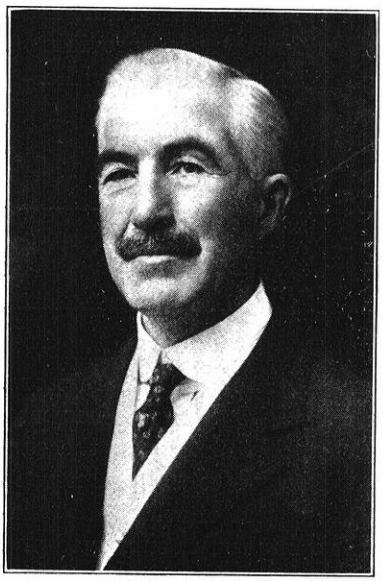
After his graduation Mr. Greaves returned to Iowa, where on April 24th, 1904 he married Miss Ethel Wyatt of Spencer, Iowa. In 1906 he moved to Sturgeon Bay, Wisconsin, where he became City Engineer, which position he held until the office was abolished some years later. During his term as City Engineer, practically all of the sewerage and water works systems of Sturgeon Bay were laid under his direction. He also acted as County Surveyor for Door County, and until the time of his death had been handling the engineering work of both Sturgeon Bay City and Door County.

The activities and interests of Mr. Greaves were by no means confined to his profession of engineering. He was a member of the Board of Directors from the ninth District of the Wisconsin State Horticultural Society; secretary of the Door County Fruit Exchange; secretary of the Door County Fair Association; member of the Henry S. Baird Lodge F. & A. M.; member of the Sturgeon Bay Chapter Royal Arch Masons; treasurer of the Methodist Church of Sturgeon Bay, and superintendent of the Methodist Sunday School. He organized the Boy Scout movement of Sturgeon Bay and was their first scout-master. Mr. Greaves was that type of man of whom it may be said the community was made richer by his having lived in it. He had the ability to make friends and to retain them; and his loss to the community and his fellow alumni is keenly felt.

SUCCESSFUL WISCONSIN ENGINEERS

FREDERICK WILLIAM FRATT

Prominent in the list of Wisconsin's successful civil engineers is the name of F. W. Fratt, president of the Union Depot Bridge and Terminal Railroad Company, The North Kansas City Development Company, and several other associated concerns. Mr. Fratt graduated as a civil engineer in 1882 and immediately became president and later chief engineer of the Wisconsin Central Railroad in Milwaukee. In 1892 he resigned this position to become chief engineer of construction of the Missouri, Kansas and Texas Railroad, Houston, Texas. In 1893, he became general manager of the Sherman, Shreveport and Southern Railroad, and when that property was absorbed by the M. K. & T. in 1896, he accepted the position of superintendent of the Texas Midland Railroad, remaining with them for two years. The following two years were devoted to street railway and electrical work as superintendent and engineer of the Galveston City Railroad. He resigned from this position January 1, 1900, to resume work with the Missouri, Kansas and Texas Railroad as chief engineer of construction. One of his notable achievements at this time was the construction of the railroad line through Houston, San Antonio, Shreveport, Joplin, and Oklahoma City, as well as the terminals at Kansas City. While his present position as president of the Union Depot Bridge and Terminal Railroad Com-



pany is that of an executive, more or less engineering work is connected with it. Mr. Fratt's greatest feat as an engineer was the construction of the Missouri River Bridge, a double deck, double track, steel structure, costing very nearly one million dollars. Upon the upper deck is a double track electric railway, two highways, and two footways, while upon the lower deck is a double track steam railway. The novel feature of this bridge is the arrangement provided for navigation. The upper deck is built unbroken, since it is high enough to allow steamboats to pass, while the lower deck is controlled by a lifting arrangement which telescopes into the posts of the upper span, providing a clear passageway of over four hundred feet for river traffic.

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CAMPUS NOTES

Beginning with the class of 1920 the electricals will follow a somewhat different program than they have had heretofore. The course in the freshman year remains the same as it has been formerly, but there has been considerable change in the succeeding years. An introductory course in electricity is now to be given in the sophomore year, the object of which is to familiarize the student with the fundamental units employed and to give him a thorough knowledge of the more simple calculations occurring in electrical work. A special course in physics, designed particularly to meet the needs of the electrical engineer, has also been developed and will extend over the sophomore and junior years. In the future, English will be given in the sophomore year, rather than in the junior year as heretofore; while shop-work, mechanics, and topographical engineering, all formerly studied by the sophomore class, have been deferred one year except the latter which will be given hereafter throughout the senior year.

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A meeting of the Wisconsin section of the American Chemical Society was held Monday, December 11 in the Woman's

Building. The affair was of the nature of a mixer, some two hundred chemists and their friends being present. Music was provided by a quartette and by a chorus of twenty chemists. Later in the evening Dr. J. H. Mathews showed a series of extremely beautiful color photographs of crystalline substances as viewed under polarized light.

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Professor Bennett is the author of bulletin No. 810 recently published by the Engineering Experiment Station of the University of Wisconsin, entitled "High versus Low Antennae in Radio Telegraphy and Telephony." Professor Bennett makes an analysis of the electric and magnetic forces set up at a great distance from an antenna composed of a horizontal network, and shows that for an antenna consisting of a network of horizontal wires, whose radius is two to three times as great as the height of the network above the ground (a condition which is approached in long distance stations) the electric and magnetic forces at a great distance from a radiator of the above type are practically independent of the height of the network above the ground. Marconi, in 1899, came to the conclusion that for antennae in use at that time (practically a single vertical wire, or a vertical wire with a small capacity area) that the "distance at which signals could be obtained varies approximately with the square of the distance of the capacities from the earth, or perhaps with the square of the length of the vertical conductors." This conclusion seems to have been assumed to hold true for antennae of modern design, in which the radiator is approximately a horizontal network. Prof. Bennett shows that this is unjustifiable.

The capacity of a horizontal network close to the ground is, of course, very large, so that it would probably be feasible to dispense with the usual power condensers and coupled circuits entirely. A series circuit comprising the capacity area, tuning inductance, and spark gap may be used. Such a circuit has the merit of oscillating at but a single frequency, while the usual coupled circuits have two frequencies of oscillations. The absorbing properties of an antenna composed of a horizontal network, whose radius is two or three times the height from the ground, are also investigated. It is shown that for waves

slightly damped, the efficiency of a low antenna as an absorber is the same as a high antenna, but that for waves that are highly damped oscillations, (atmospheric) the low antenna is less responsive, this is decidedly advantageous.

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Mr. C. M. Ward, who succeeds Mr. Weidner, instructor in hydraulics, is a graduate of the University of Michigan, class of '14, M. S. '16. Since graduation, Mr. Ward has been instructor in surveying and has conducted considerable research in hydraulic engineering. During the last summer, he has had charge of the State Highway construction work near Lansing, Michigan.

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The department of Mechanical Engineering has recently added to the equipment of the Steam and Gas laboratory a four cylinder Lyons Knight engine, one of the products of the Lyons-Atlas Motor Co. of Indianapolis, Indiana. The motor which is of the Knight sleeve valve type has a bore of 4½ inches and a stroke of 5½ inches, and will develop about fifty horse power. The purchase of this engine is in line with the policy of the department to have represented in its laboratory the leading types of motors.

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The Annual Engineers' Dance was given Saturday, December 16 at the Woman's Building. The affair was well attended and in spite of the inclement weather and the fact that there were many other dances in the same evening, was a real success. The programs for the dance were quite unique in that they were exact reproductions of a standard report, the object of the experiment on Simple Harmonic Motion, as it was stated, being to have a good time. Mr. and Mrs. J. G. Callan, Mr. and Mrs. A. V. Millar, Mr. and Mrs. G. L. Larson, and Mr. and Mrs. F. A. Kartak acted as chaperones.

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Mr. J. P. Schwada c '11, who until recently has been instructor in civil engineering here, has withdrawn from this work to accept a position with the Wisconsin Railroad Commission.

Mr. Frederick Kressmann, formerly of the Forest Products laboratory is now manager of the Wood Waste Recovery Plant at Fullerton, Louisiana, manufacturing ethyl alcohol from the wood waste.

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On Friday, December 8, the Chemical Engineering Society gave its annual mixer. Short talks by Professor O. L. Kowalke and Mr. C. F. Burgess, director of the Burgess Laboratories here in Madison, added appreciably to the interest of the affair.

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At the meeting of the U. W. Engineers' Club on December 15, a number of new members were initiated and the election of the officers for the coming year was held. Raymond E. Porter takes the place of Charles Goldammer as president. Charles A. Rau and H. B. Martin were elected vice president and secretary respectively.

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A large new fan for ventilating purposes is being installed in Science Hall. The larger parts of this fan, which are now lying in front of the building, will be disassembled and after being carried through the grating will be set up directly under the steps. It is said that this fan will take the place of the two old fans which have been now in operation for over thirty years and that it will deliver over twenty-five per cent more air for the building at a much less expenditure of energy.